

SOIL SURVEY OF  
**Santa Fe Area, New Mexico**

(Santa Fe County and Part of Rio Arriba County)



United States Department of Agriculture  
Soil Conservation Service and  
Forest Service and  
United States Department of the Interior,  
Bureau of Indian Affairs  
In cooperation with  
New Mexico Agricultural Experiment Station



Major fieldwork for this soil survey was done in the period 1960-68. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in this publication refer to conditions in the Area in 1968. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Santa Fe-Pojoaque, Edgewood, and Upper Pecos Natural Resource Conservation Districts.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

## HOW TO USE THIS SOIL SURVEY

**T**HIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

### Locating Soils

All the soils of the Santa Fe Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the timber suitability group, range site, and wildlife habitat group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation

for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the range sites, and the timber suitability groups.

*Foresters and others* can refer to the section "Use of the Soils as Timberland," where the soils of the Area are grouped according to their suitability for trees.

*Game managers, sportsmen, and others* can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

*Ranchers and others* can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

*Community planners and others* can read about soil properties that affect the choice of sites for recreation areas in the section "Use of the Soils for Recreation."

*Engineers and builders* can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices and structures.

*Scientists and others* can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

*Newcomers in the Santa Fe Area* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "Additional Facts About the Area."

**Cover:** The city of Santa Fe is expanding into this area of the Pojoaque-Rough broken land complex. Limitations for most urban uses in this area are moderate to severe because of slope. The Sangre de Cristo Mountains are in the background.

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# SOIL SURVEY OF SANTA FE AREA, NEW MEXICO

## SANTA FE COUNTY AND PART OF RIO ARriba COUNTY

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SOIL SURVEYED BY JAMES J. FOLKS, EDWARD M. BANNING, JR., FRANK E. LOWRY, SOIL CONSERVATION SERVICE; KENNETH J. BOWMAN AND DONALD W. MEISTER, FOREST SERVICE; AND ELMER J. KINGSOLVER, BUREAU OF INDIAN AFFAIRS

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE NEW MEXICO AGRICULTURAL EXPERIMENT STATION

**T**HE SANTA FE AREA is at the southern end of the Rocky Mountains in the north-central part of the State (fig. 1). It includes Santa Fe County and part of Rio Arriba County. Size of the Area is about 1,933 square miles, or 1,237,420 acres.

Santa Fe, the county seat of Santa Fe County and the capital of New Mexico, is on U.S. Highways Nos. 64, 84, 85, and 285 in the north-central part of the Area. Daily flights by airlines provide transportation to and from Santa Fe. A rail spur for freight connects Santa Fe with the main line of the Atchison, Topeka, and Santa Fe Railway at Lamy, 20 miles southeast of Santa Fe, but passenger service between Santa Fe and Lamy is by bus.

The climate of the Area, exclusive of high mountain regions, is semiarid continental. The summers are cool and pleasant, and the winters are crisp, clear, and sunny. Wind velocities are low, precipitation is light, and humidity is relatively low.

Irrigated land, range, and forest land dominate the Area. The irrigated farms are in the southern part of the Area, which is pump irrigated, and in the northern part, which is surface irrigated. The main crops in the southern part of the Area are corn, alfalfa, small grain, potatoes, and pinto beans. Dominating the northern part are alfalfa, orchards, and truck crops. The main fruit grown is apples.

Range is throughout the Area and is used primarily for grazing beef cattle. It is described in detail in the section "Use of the Soils for Range."

The United States Department of Agriculture Forest Service administers 255,594 acres of federally owned forest land. This acreage is mostly in the northeastern part of the survey area.

Most of the Area is drained by the Rio Grande. A small section in the northeast is drained by the Pecos River. The southern part drains into the closed Estancia Valley.

### *How This Survey Was Made*

Soil scientists made this survey to learn what kinds of soil are in the Santa Fe Area, where they are located, and

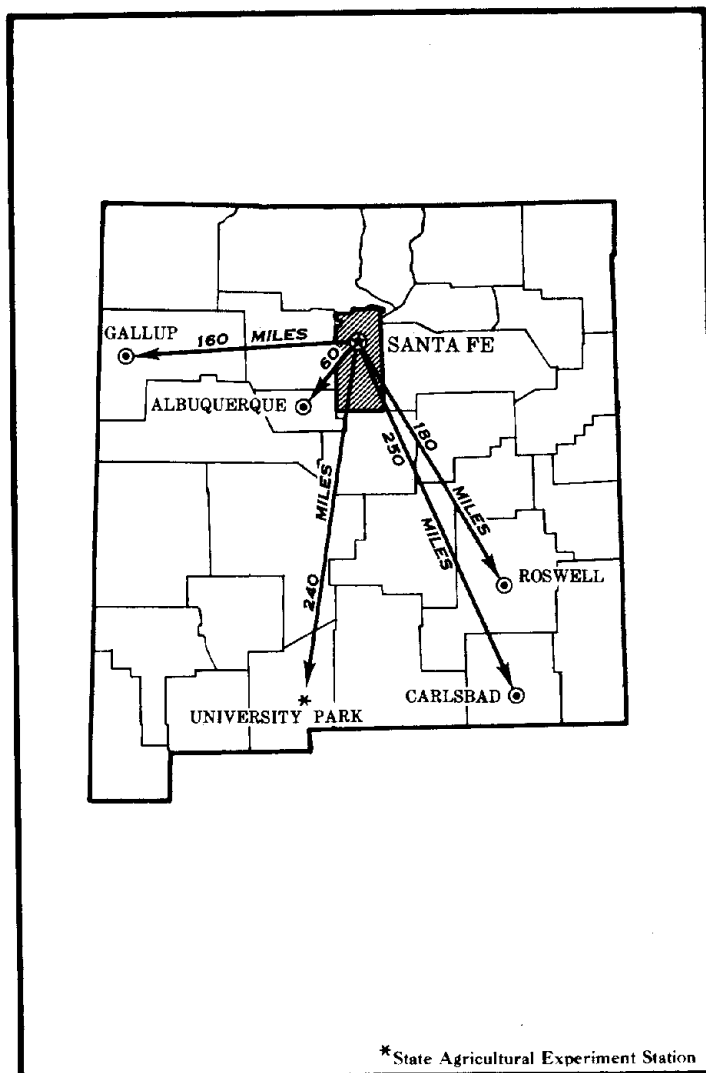


Figure 1.—Location of Santa Fe Area in New Mexico.



how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soil. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series (7).<sup>1</sup> Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Santa Fe and Pojoaque, for example, are the names of two soil series in the Santa Fe Area. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Fruitland sandy loam, 0 to 3 percent slopes, is one of several phases in the Fruitland series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Santa Fe Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. El Rancho-Fruitland complex is an example.

A soil association is made up of adjacent soils that occur

as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Silver-Pojoaque association, undulating, is an example.

Most surveys include areas where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Riverwash is an example of a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundation for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

## Soil Survey Intensities

Part of the Santa Fe survey area was mapped at low intensity and part at high intensity. Range and timberland were mapped at low intensity. The soils mapped at low intensity were examined at moderate to wide intervals. In several places, two or more soils were mapped together as a complex or an association. Each of these multiple mapping units was named for the major soil series in it, and the dominant soil was named first; for example, Silver-Pojoaque association, undulating. If the acreage of an individual soil was large enough, the soil was mapped separately. A wide range of slope was permitted within a unit if there were no major differences in use and management.

The major built-up area around the City of Santa Fe

<sup>1</sup> Italicized numbers in parentheses refer to Literature Cited, p. 112.

and the small valleys used for irrigated crops were surveyed at high intensity. These soils were examined at closer intervals than those mapped at low intensity and were mapped in more detail. Also, fewer inclusions of other soils are in each mapping unit.

The type of symbol will show in which intensity the soil is mapped. The first letter is a capital, whether the soil was mapped at a high or low intensity. The second letter is lower case if the soil was mapped at high intensity and upper case if the soil was mapped at low intensity.

Most mapping units consist of individual soils rather than of associations or complexes. Slope classes were combined if there was no significant difference in use and management. The scale of the soil maps at the back of this survey is the same for both intensities. The soils are discussed in the text without reference to survey intensities. If the soil is mapped at both intensities, however, the survey intensities are mentioned in the text.

In the Guide to Mapping Units at the back of this publication, soils mapped at high intensity are separated from those mapped at low intensity. Thus, Calabazas loam, 0 to 10 percent slopes, a soil mapped at low intensity, is listed under the heading "Low-intensity Survey." Cerrillos fine sandy loam, 5 to 10 percent slopes, on the other hand, was mapped at high intensity and is listed under the heading "High-intensity Survey." Cerrillos fine sandy loam, 0 to 5 percent slopes, is in both categories, but it has one mapping symbol where it has been mapped at low intensity and another where it has been mapped at high intensity.

## General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Santa Fe Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife habitat, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 13 soil associations in the Santa Fe Area are discussed in the following pages.

The soil associations in this survey have been grouped into five general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages. The terms for texture used in the title for the associations apply to the dominant texture of the subsoil or the texture of a significant thickness of soil material below the surface layer. Minor soils are listed in the associations in the order of their extent.

## Soils of Recent Alluvial Valleys

Nearly all of the soils in the Santa Fe Area that are surface irrigated are in alluvial valleys along the major streams. The Santa Cruz Reservoir on the Santa Cruz River is the only water-storage reservoir in the Area used principally for irrigation. Water is diverted directly into irrigation ditches from such other streams as the Pojoaque River, Rio Tesuque, and Cienega Creek. Irrigation water is scant in dry years.

Along most of the streams the high-line irrigation ditch is much higher than the flood plain. Thus, only a small acreage of all the irrigated soils is subject to downstream flooding. Numerous side arroyos or intermittent drainage-ways that flow during rainstorms, however, cause considerable damage to irrigation structures and crops.

### 1. El Rancho-Fruitland association

*Level to gently sloping, deep, loamy soils; on terraces and alluvial fans*

This association consists of well-drained soils that formed in mixed alluvium from the Santa Fe Formation and in material derived from granitic rocks. It is in the northern part of the survey area. Slopes are 0 to 5 percent. The vegetation is mid grasses, except where the soils are irrigated. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days.

This association makes up about 2 percent of the survey area. About 40 percent of the association is El Rancho soils, and about 20 percent is Fruitland soils. Minor soils make up the remaining 40 percent, of which about half is Ancho soils and Bluewing soils on flood plains and terraces, and about half is Pojoaque soils, Riverwash, and Rough broken land.

El Rancho soils are on terraces generally apart from the flood plains. They have a surface layer of light reddish-brown sandy clay loam over layers of light reddish-brown and light-brown sandy clay loam.

Fruitland soils are on alluvial fans, close to the channels where alluvial deposition has been relatively rapid. They have a surface layer of brown sandy clay loam or sandy loam. The substratum is light-brown fine sandy loam to a depth of 5 feet or more.

This association is used for irrigated crops and range, as wildlife habitat, and for water supply. Areas of Riverwash are used as a source for sand and gravel.

Farms average about 5 to 10 acres. Alfalfa and apples are the principal irrigated crops.

Wildlife on this association is mostly mourning dove and blue quail. A few of the irrigation reservoirs are stocked with fish, mostly trout.

In dry years the water supply is limited.

## Soils of Dissected Piedmont Plains

These soils are in an area that extends from the northern end of the Santa Fe Area south to Torrance County. The area is a dissected piedmont plain about 12 miles wide. It is bounded on the east by the Sangre de Cristo Mountains and on the west by basalt flows. The soils in the northern part of this area formed in reworked material of the Santa Fe formation and those in the central part formed

in material weathered from shale. Those in the southern part formed in mixed alluvium. The area north of the city of Santa Fe is mostly Rough broken land, and it is dissected by many drainageways. The soils south of the city of Santa Fe are gently rolling. Nearly all of the soils are used for range.

## **2. Pojoaque-Rough broken land association**

*Moderately sloping to moderately steep, deep, loamy and gravelly soils; on upland terraces and Rough broken land*

This association consists of well-drained soils and Rough broken land, a land type. It is in the northern part of the survey area. The soils formed in mixed alluvium of the Santa Fe formation. Slopes are 5 to 25 percent. Rough broken land is hilly to very steep. The vegetation is mid grasses, shrubs, and pinyon and juniper. Elevation ranges from 6,600 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days.

This association makes up about 13 percent of the survey area. About 45 percent of the association is Pojoaque soils, and 45 percent is Rough broken land. Minor soils make up the remaining 10 percent, of which about half is Panky, Fivemile, and Bluewing soils, and about half is Riverwash and Badland.

The Pojoaque soils are intermingled with the Rough broken land. They are in places where the soils have become somewhat stabilized, generally on the ridgetops between drainageways. Pojoaque soils have a surface layer of light reddish-brown sandy clay loam over layers of light reddish-brown gravelly sandy clay loam and sandy clay loam.

Rough broken land is very shallow to sandstone, siltstone, and shale.

This association is used for range, as wildlife habitat, and for community development and water supply.

Ranches are large, carrying capacities are low, and water supplies are limited. Stock tanks supply most of the water. Livestock is mainly cattle.

Runoff is mostly from Pojoaque soils and Rough broken land. In places growth of pinyon and juniper is controlled mechanically. Maintaining maximum cover on range helps to minimize the hazard of erosion.

Wildlife on this association is mourning dove and quail.

## **3. Las Lucas-Pojoaque association**

*Nearly level to hilly, deep, loamy and gravelly soils; on uplands and dissected, eroded terraces*

This association consists of well-drained soils that formed in material weathered from shale and in old alluvium of the Santa Fe formation that has been reworked by water. It is in the south-central part of the survey area. Slopes are 1 to 25 percent. The vegetation is mid grasses and scattered pinyon and juniper. Elevation ranges from 6,200 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days.

This association makes up about 7 percent of the survey area. About 30 percent of the association is Las Lucas soils, and about 30 percent is Pojoaque soils. Minor soils make up the remaining 40 percent, of which about half is Galisteo, Travessilla, Bernal, and Persayo soils, and about

half is Rough broken land, Shale rock land, Gullied land, Alluvial land, saline, and Rock Outcrop.

Las Lucas soils are nearly level to moderately sloping. These soils are on uplands. They have a surface layer of brown heavy loam and a subsoil of pale-brown and light yellowish-brown clay loam.

Pojoaque soils are on upland terraces. They are gently rolling to hilly and are on the breaks of drainageways. Pojoaque soils have a surface layer of light reddish-brown sandy clay loam over layers of light reddish-brown gravelly sandy clay loam and sandy clay loam.

These soils are used for range, as wildlife habitat, and for water supply. Livestock is mainly cattle.

Ranches are large, carrying capacities are low, and water supplies are limited. Stock tanks supply most of the water.

Wildlife on this association is deer, quail, and mourning dove. Indian artifacts are in scattered places throughout this association.

## **4. Panky-Pojoaque-Harvey association**

*Level to hilly, deep, loamy to clayey soils; on old alluvial fans and dissected, eroded terraces*

This association consists of well-drained soils that formed in old mixed alluvium. It is in the central part of the survey area. Slopes are 0 to 25 percent. The vegetation is mid grasses and scattered pinyon and juniper. Elevation ranges from 6,200 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 170 days.

This association makes up about 13 percent of the survey area. About 35 percent of the association is Panky soils, about 25 percent is Pojoaque soils, and about 20 percent is Harvey soils. The minor Cerrillos, Agua Fria, Silver, Fivemile, Santa Fe, and La Fonda soils make up the remaining 20 percent.

Panky soils are level to moderately sloping and are on broad uplands between drainageways. They have a surface layer of light-brown fine sandy loam and a subsoil of reddish-brown loam and heavy clay loam. The substratum is pinkish-white sandy clay loam.

Pojoaque soils are gently rolling to hilly and are on breaks bordering drainageways (fig. 2). They have a surface layer of light reddish-brown sandy clay loam over layers of light reddish-brown gravelly sandy clay loam and sandy clay loam.

Harvey soils are nearly level to moderately sloping and are on sides of drainageways. They have a surface layer of brown loam and light-brown sandy clay loam over a layer of brown clay loam. The substratum is pink and light reddish-brown sandy clay loam and clay loam.

This association is used for range, as wildlife habitat, and for water supply. Most grazing is by cattle.

Ranches are large, carrying capacities are moderate, and water supplies are adequate. The water is generally kept in stock tanks and is pumped by windmills or is kept in ranch ponds (earthen dams) and comes from runoff.

Runoff is largely from the Pojoaque soils. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife is mostly mourning dove and blue quail.

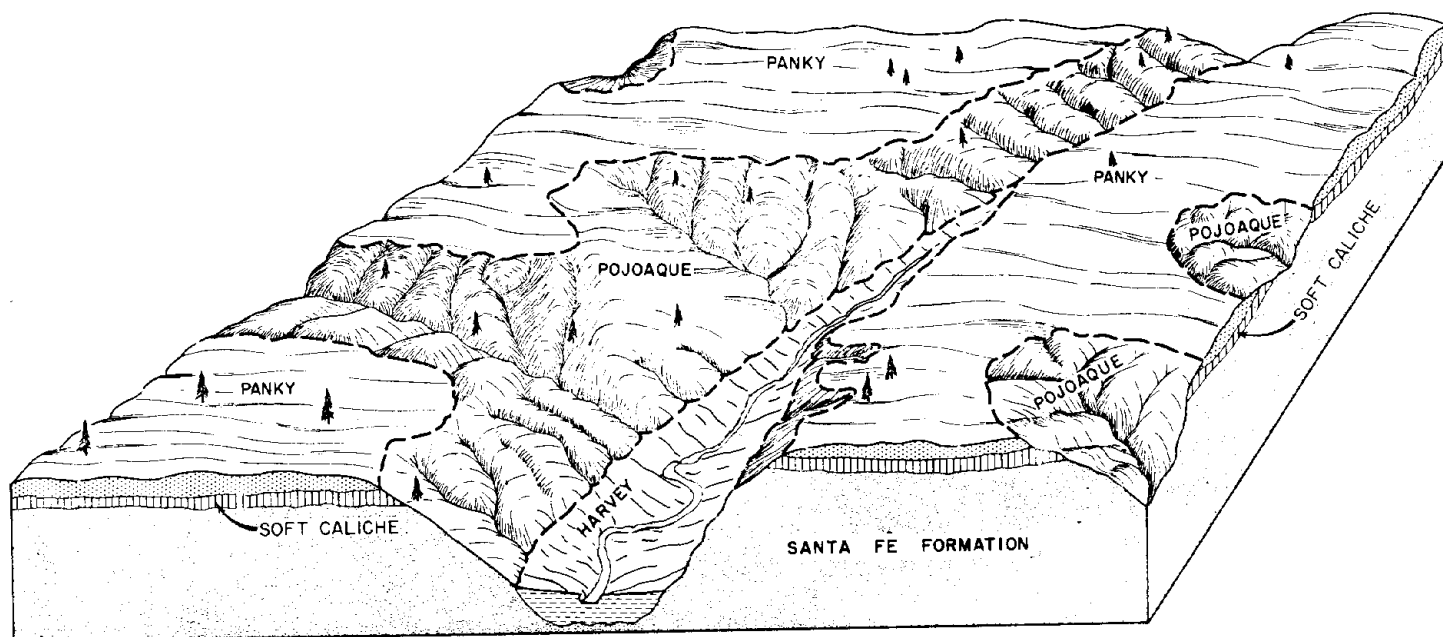


Figure 2.—Pattern of soils typical of association 4.

### 5. Witt-Harvey-Clovis association

*Level to moderately sloping, deep, loamy soils; on old alluvial fans in uplands of the Estancia Valley*

This association consists of well-drained soils that formed in old mixed alluvium. It is in the southern part of the survey area. Slopes are 0 to 9 percent. The vegetation is mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 170 days.

This association makes up about 11 percent of the survey area. About 50 percent of the association is Witt soils, about 30 percent is Harvey soils, and about 15 percent is Clovis soils. The minor La Brier, Penistaja, and Dean soils make up the remaining 5 percent.

Witt soils are on broad uplands between drainageways. They have a surface layer of brown loam and a subsoil of reddish-brown clay loam and yellowish-red sandy clay loam. The substratum is pinkish-white loam.

Harvey soils are nearly level to moderately sloping and are on sides of drainageways (fig. 3). They have a surface layer of brown loam and light-brown sandy clay loam over a layer of brown clay loam. The substratum is pink and light reddish-brown clay loam and sandy clay loam.

Clovis soils are on broad uplands between drainageways. They have a surface layer of brown loam and a subsoil of reddish-brown, brown, and light-brown sandy clay loam and clay loam. The substratum is light-brown sandy clay loam and pinkish-white fine sandy loam.

All of the soils of this association are used for grazing cattle. Some areas are also used as wildlife habitat, for water supply, and, to a limited extent, for irrigated and dryland farming.

Ranches are small, carrying capacities are moderate, and water supplies are adequate. Windmills supply most

of the water. Dryfarming has greatly declined, and what little is left is mostly small grain grown mainly on Witt and Clovis loams along the Torrance County line. Irrigated crops are corn silage, alfalfa, small grain, and potatoes.

The hazard of soil blowing is moderate in dryfarmed areas and in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices on dryfarmed and irrigated cropland help to minimize the hazard of soil blowing.

Wildlife is mostly mourning dove, rabbits, and blue quail.

### 6. Harvey-Dean-Tapia association

*Nearly level to moderately sloping, loamy soils that are shallow to soft caliche and deep, loamy soils; on uplands*

This association consists of well-drained soils that formed in mixed alluvium. It is in the southeastern part of the survey area. Slopes are 1 to 9 percent. The vegetation is mid grasses and a few scattered pinyon and juniper. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 170 days.

This association makes up about 9 percent of the survey area. About 30 percent of the association is Harvey soils, about 25 percent is Dean soils, and about 15 percent is Tapia soils. The minor Penistaja, Pastura, Otero, Palma, and Hagerman soils make up the remaining 30 percent.

Harvey soils are on side slopes. They have a surface layer of brown loam and light-brown sandy clay loam over a layer of brown clay loam. The substratum is light reddish-brown and pink clay loam and sandy clay loam.

Dean soils are mostly on crests of uplands. They have a surface layer of brown loam over a layer of light-brown



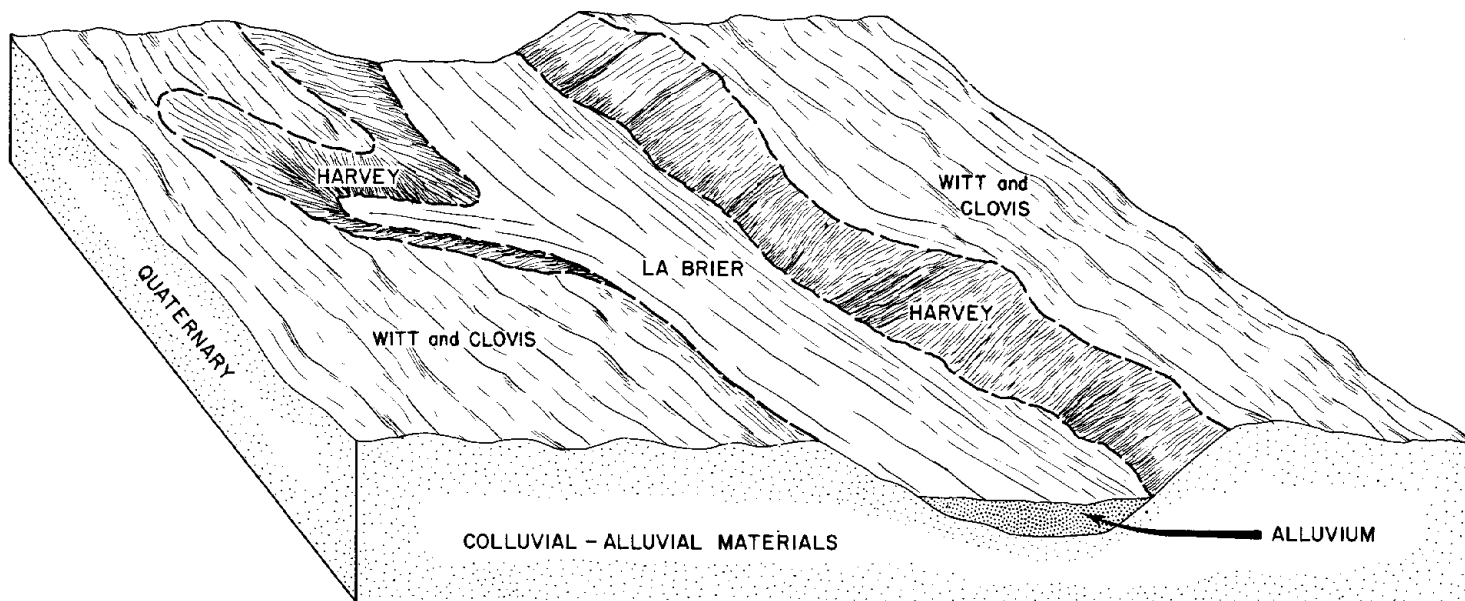


Figure 3.—Pattern of soils typical of association 5.

loam. The substratum is pink to very pale brown, very gravelly caliche.

Tapia soils are in broad, smooth areas between drainageways and depressions. They have a surface layer of brown loam and a subsoil of reddish-brown and light-brown clay loam. The substratum is pink gravelly loam.

Nearly all of these soils are used for grazing by cattle. Some areas are also used as wildlife habitat and for water supply.

Ranches are medium in size, carrying capacities are moderate, and water supplies are adequate. The water is generally kept in stock tanks and is pumped by windmills or is kept in ranch ponds (earthen dams) and comes from runoff.

The hazard of soil blowing is moderate in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of soil blowing.

Wildlife is mostly mourning dove, a few blue quail, and rabbits.

### Soils of Mesas, Cinder Cones, and Basalt Flows

The soils of the mesas are very shallow to moderately deep over sandstone and limestone. They are in the east-central part of the survey area, mostly around Lamy.

The soils that formed on cinder cones and basalt flows are in the northwestern part of the Area. They are shallow to deep, and they are stony in places.

The soils in this group are used for grazing by cattle and as wildlife habitat.

#### 7. Majada-Calabasas-Apache association

*Level to steep, deep to shallow, loamy and very cobbly soils; on old basalt flows and cinder cones*

This association consists of well-drained soils that formed in material weathered from basalt and other volcanic debris. It is in the northwestern part of the survey area. Slopes are 0 to 50 percent. The vegetation is pinyon

and juniper, mid grasses, forbs, and shrubs. Elevation ranges from 6,400 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 140 to 170 days.

This association makes up about 8 percent of the survey area. About 25 percent of the association is Majada soils, about 25 percent is Calabasas soils, and about 15 percent is Apache soils. The minor Silver, Montoso, Los Alamos, and Guaje soils make up about 20 percent of this association, and Tuff rock land and Basalt rock land make up about 15 percent.

Majada soils are hilly to steep. They have a surface layer of grayish-brown fine sandy loam and dark grayish-brown cobbly fine sandy loam. The subsoil is dark grayish-brown and pale-brown very cobbly sandy clay loam and brown very cobbly sandy clay. The substratum is light-gray and white very cobbly loam.

Calabasas soils are level to moderately steep. These soils are around hills capped with Majada soils. Calabasas soils have a surface layer of brown loam and a subsoil of pinkish-gray heavy loam to light clay loam and light-brown heavy loam. The substratum is very pale brown and pinkish-white gravelly loam.

Apache soils are nearly level to strongly sloping (fig. 4) and are generally along drainageways and the front of basalt flows. They have a surface layer of brown stony fine sandy loam and a layer of light-brown sandy clay loam underlain, at a depth of 11 to 20 inches, by basalt.

Most of the acreage of this association is federally owned and is rangeland used for grazing cattle by permit. Some areas are also used as wildlife habitat, for water supply, and as a source for rock, pumice, and cinders useful in building and landscaping. The pinyon and juniper that grow on the association are a good source for firewood and fenceposts.

Water supplies are very limited in this association. Stock tanks and artificial collecting devices supply most of the water.

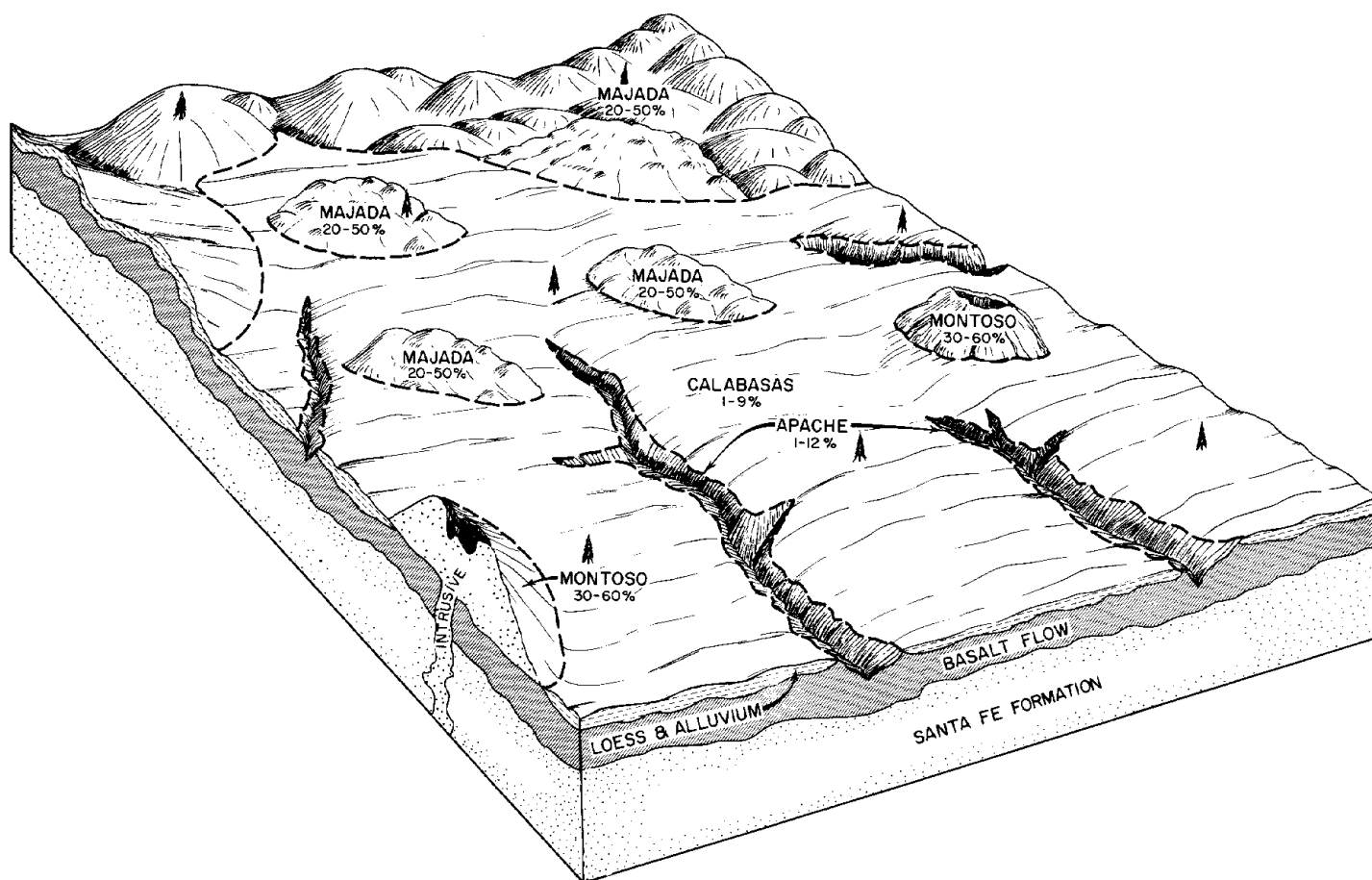


Figure 4.—Pattern of soils typical of association 7.

Runoff is largely from the Apache soils. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife on this association is mostly deer, blue quail, and mourning dove. Indian artifacts are in scattered places throughout the association.

#### 8. Travessilla-Rock outcrop-Bernal association

*Nearly level to moderately steep, shallow to very shallow, loamy soils and Rock outcrop; on mesas*

This association consists of well-drained soils and Rock outcrop, a land type. The soils formed in material weathered from sandstone. Slopes are 1 to 25 percent. This association is mainly in the eastern part of the survey area. The vegetation is mid grasses, shrubs, forbs, pinyon, and juniper. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days.

This association makes up about 13 percent of the survey area. About 25 percent of the association is Travessilla soils, about 20 percent is Rock outcrop, and about 15 percent is Bernal soils. The minor Prewitt, Rednun, Wilcoxson variant, Chimayo, Ortiz, Las Lucas, Cueva, and Encierro soils make up the remaining 40 percent.

Travessilla soils are nearly level to moderately steep

and are generally near the edge of mesa tops and in bench-like areas of mesa fronts. They have a surface layer of reddish-brown loam over sandstone.

Rock outcrop is nearly level to very steep. It is intermingled with Travessilla soils and, to a limited extent, with Bernal soils.

Bernal soils are nearly level to gently sloping and are generally on mesa tops (fig. 5). They have a surface layer of brown fine sandy loam and a subsoil of reddish-brown very fine sandy loam and clay loam. Sandstone is at a depth of 8 to 20 inches.

All the soils are used for grazing by cattle. Some areas are also used as wildlife habitat and for water supply. The pinyon and juniper of this association are a good source for firewood and fence posts.

Ranches are large, carrying capacities are low, and water supply is limited. Stock tanks supply most of the water.

Runoff is largely from the Rock outcrop. The hazard of water erosion is moderate in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife is mostly deer, mourning dove, and a limited number of blue quail and turkey. Indian artifacts are present in scattered places throughout the association.

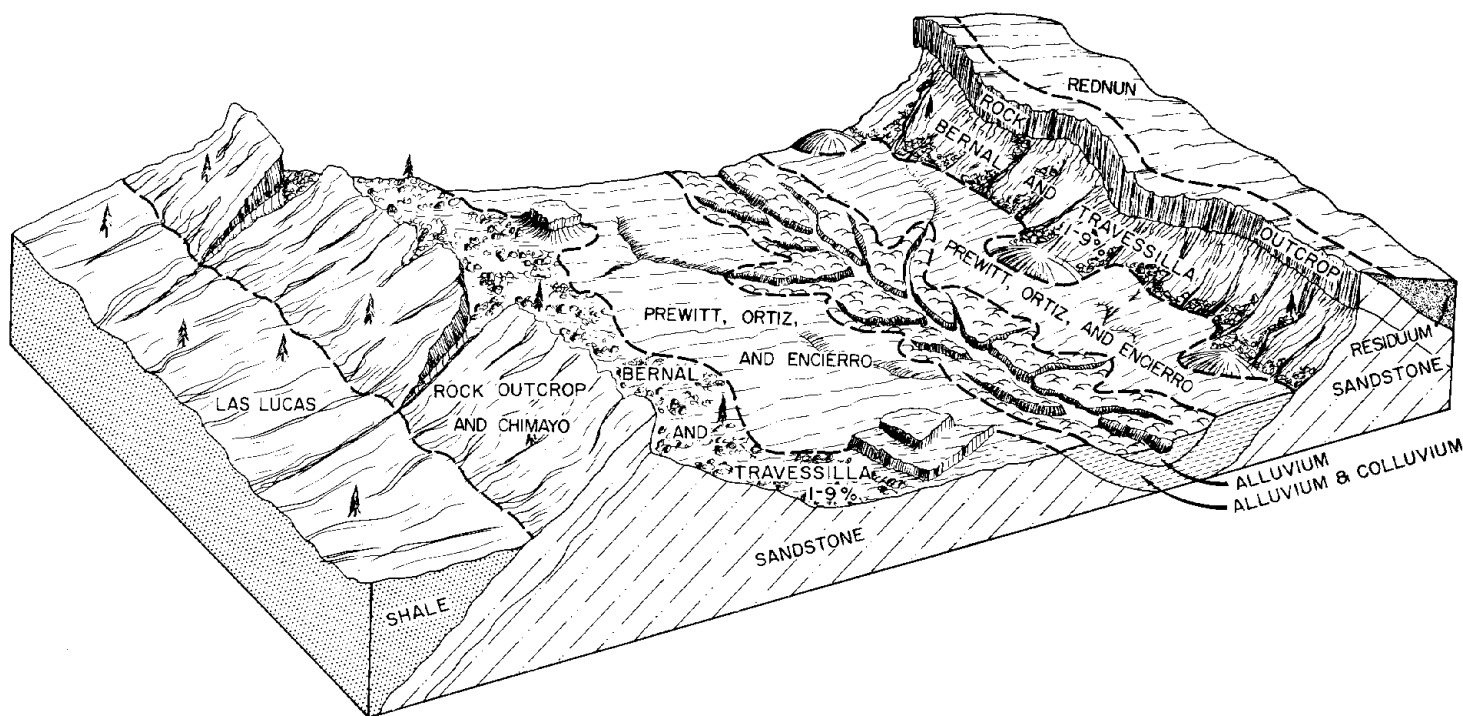


Figure 5.—Pattern of soils typical of association 8.

## Soils of Old Lake Basins

Basin lands are at the northern end of Old Lake Estancia in the extreme southern end of the survey area. The soils are underlain by lacustrine sediment at varying depths.

### 9. La Brier-Willard association

*Level to nearly level, deep, loamy to clayey soils; on alluvial fans and old lake benches*

This association consists of well-drained soils that formed in mixed alluvium and lake sediment. It is in the southern part of the survey area. Slopes are 0 to 3 percent. The vegetation is mid grasses, forbs, and shrubs. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days.

This association makes up about 1 percent of the survey area. About 70 percent of the association is La Brier soils, and about 15 percent is Willard soils. The minor Moriarty, Penistaja, Harvey, and Witt soils make up the remaining 15 percent.

La Brier soils are on alluvial fans of drainageways that empty into the lake depression. They have a surface layer of brown loam and a subsoil and substratum of dark reddish-gray clay loam.

Willard soils are level and nearly level and are in areas adjacent to the extreme north end of Old Lake Estancia. They have a surface layer of brown loam and a subsoil of pink light clay loam. The substratum is very pale brown clay loam.

These soils are used for grazing by cattle. Some areas are also used as wildlife habitat, for water supply, and, to a limited extent, for irrigated farming. Alfalfa and pota-

toes are the main irrigated crops. This association is in-extensive in the Sante Fe Area, but it is the very northern tip of Old Lake Estancia, extending north from Torrance County.

Carrying capacities are moderate to high, and water supplies are adequate. Windmills supply most of the water.

The hazard of soil blowing is moderate in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of soil blowing.

Wildlife is mostly rabbits, mourning dove, and blue quail.

## Soils of the Sangre de Cristo and Ortiz Mountains and Foothills

Some of the soils in this group are in an area about 10 miles wide and 30 miles long in the Sangre de Cristo Mountains in the northeastern part of the survey area. They formed mostly in material weathered from granite, gneiss, and schist. The rest of the soils are in an area of about 16 square miles in the Ortiz and San Pedro Mountains near Golden in the southwestern part of the county. They also formed in granitic material.

### 10. Laporte-Witt association

*Level to moderately steep, shallow to deep, loamy soils; on low foothills and alluvial fans*

This association consists of well-drained soils that formed in material weathered from limestone and in old mixed alluvium. It is in the southwestern corner of the survey area. Slopes are 0 to 25 percent. The vegetation is mid grasses, forbs, shrubs, pinyon, and juniper. Elevation ranges from 6,200 to 6,800 feet. The mean annual precipita-

tion is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 160 days.

This association makes up about 1 percent of the survey area. About 65 percent of the association is Laporte soils, and about 25 percent is Witt soils. Minor soils of the Harvey series and limestone outcrops make up the remaining 10 percent.

Laporte soils are moderately sloping to moderately steep. These soils are on low hills and mesas. They have a surface layer of dark grayish-brown loam over a layer of brown sandy clay loam and gravelly loam. Limestone bedrock is at a depth of 8 to 20 inches.

Witt soils are on smooth uplands around Laporte soils. They have a surface layer of brown loam and a subsoil of reddish-brown clay loam and yellowish-red sandy clay loam. The substratum is pinkish-white loam.

This association is used for range, as wildlife habitat, and for water supply. Pinyon and juniper that grow on the Laporte soils furnish some firewood and fenceposts. Where precipitation is higher, some small grain is dryfarmed on the Witt soils.

Ranches are small, carrying capacities are moderate, and water supplies are adequate. The water is generally pumped by windmills and kept in stock tanks or is received as runoff and kept in ranch ponds (earthen dams).

Runoff is largely from Laporte soils. Maintaining maximum cover on range and using soil and water conservation practices on dryfarmed cropland help to minimize the hazard of erosion.

Wildlife is mostly deer, mourning dove, and blue quail.

#### **11. Rednun-Pena-Stony rock land association**

*Nearly level to moderately steep, deep, loamy to clayey and very gravelly soils; on uplands and alluvial fans; and steep to very steep, stony rock land; on foothills and mountain foot slopes*

This association consists of well-drained soils and the land type Stony rock land. It is in the southwestern part of the survey area. The soils formed in mixed alluvium. The soils have slopes of 1 to 25 percent. Stony rock land has slopes of 20 to 100 percent. The vegetation is mid grasses, pinyon, and juniper. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days.

This association makes up about 5 percent of the survey area. About 50 percent of the association is Rednun soils, about 25 percent is Pena soils, and 15 percent is Stony rock land. Minor soils of the Cerrillos, Travessilla, and Panky series make up the remaining 10 percent.

Rednun soils are nearly level to moderately sloping. They are in smooth areas between drainageways and depressions. These soils have a surface layer of reddish-brown loam and a subsoil of brown and dark-brown heavy clay loam. The substratum is dark-brown clay loam and very fine sandy clay loam.

Pena soils are nearly level to moderately steep, and they generally border drainageways. They have a surface layer of dark reddish-brown stony clay loam over pinkish-gray very gravelly clay loam and very gravelly loam.

Stony rock land is steep to very steep. It is on hills and side slopes.

The soils of this association are used for grazing cattle, as wildlife habitat, and for water supply.

Ranches are large, carrying capacities are moderate, and water supplies are somewhat limited. The water is generally pumped by windmills and kept in stock tanks or is received as runoff and kept in ranch ponds (earthen dams).

Runoff is largely from Stony rock land. The pinyon and juniper that grow on this association are a source for firewood and fenceposts. The hazards of soil blowing and water erosion are moderate in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife is mostly deer, mourning dove, and blue quail.

#### **12. Chimayo-Mirabal-Supervisor association**

*Moderately sloping to very steep, shallow to moderately deep, loamy and very gravelly or very stony soils; on mountain foot slopes*

This association consists of well-drained soils that formed in material weathered from granite, gneiss, and schist. It is in the northeastern part of the survey area. Slopes are 5 to 100 percent. The vegetation is ponderosa pine, fir, pinyon, juniper, mid grasses, shrubs, and forbs. Elevation ranges from 7,500 to 9,500 feet. The mean annual precipitation is 15 to 24 inches, and the mean annual air temperature is 42° to 52° F. The frost-free season is 50 to 140 days.

This association makes up about 8 percent of the survey area. About 40 percent is Chimayo soils, about 35 percent is Mirabal soils, and about 20 percent is Supervisor soils. Minor soils of the Capillo, Santa Fe, Zuni, and Borrego series and the land types Stony rock land, Alluvial land, gravelly, and Rock outcrop make up the remaining 5 percent.

The Chimayo soils are at lower elevations than the Supervisor and Mirabal soils.

Chimayo soils have a surface layer of grayish-brown stony loam over a layer of light brownish-gray very stony loam. Granite, gneiss, or schist bedrock is at a depth of 12 to 20 inches.

Mirabal soils have a surface layer of dark grayish-brown stony loam over a layer of grayish-brown and brown very stony loam. Granite, gneiss, or schist bedrock is at a depth of 20 to 30 inches.

Supervisor soils have a surface layer of dark-gray and dark grayish-brown gravelly sandy loam over a layer of pale-brown very gravelly light sandy loam. Granite, gneiss, or schist bedrock is at a depth of 20 to 30 inches.

This association is used for timber production, for range, as wildlife habitat, and for water supply and recreation. The Chimayo soils and, to a very limited extent, the Mirabal and Supervisor soils are used for grazing cattle. These soils are mostly within the boundaries of the Santa Fe National Forest.

Water supplies in this association are limited to stock tanks, springs, and running streams.

Runoff is rapid on Chimayo, Mirabal, and Supervisor soils. The hazard of water erosion is moderate to severe in areas where range is in poor condition. Maintaining maximum cover on range and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife is mostly deer and turkey. Also, a few bears are present in places.



### 13. *Nambe-Cundiyo association*

*Moderately steep to very steep, deep, loamy and very cobbly or very stony soils; on mountains*

This association consists of well-drained soils that formed in alluvium and glacial till from granite, gneiss, and schist. It is in the northeastern part of the survey area. Slopes are 20 to 100 percent. The vegetation is spruce, fir, aspen, and pine and a sparse understory of mid grasses and forbs. Elevation ranges from 9,200 to 12,000 feet. The mean annual precipitation is 26 to 40 inches, and the mean annual air temperature is 40° to 45° F. The frost-free season is 40 to 80 days.

This association makes up about 9 percent of the survey area. About 45 percent of the association is Nambe soils and 25 percent is Cundiyo soils. Minor soils of the Bobtail, Fortwingate variant, McVickers variant, Penitente, Lunch variant, and Adel series and the land types Alluvial land, cobbly, and Rock outcrop make up the remaining 30 percent.

Nambe soils are generally at higher elevations on the mountains. They have a surface layer of very dark grayish-brown gravelly loam and a subsurface layer of brown loam. The subsoil is brown, light stony to very stony sandy loam. The substratum is brown very stony sandy loam.

Cundiyo soils are at lower elevations on the mountains. They have a surface layer of pale-brown gravelly sandy loam and very cobbly sandy loam. The subsoil is very pale brown and light yellowish-brown very cobbly loam.

This association is used for timber production, as wildlife habitat, and for water supply and recreation. The soils are only in the Santa Fe National Forest.

Managing timber properly and using soil and water conservation practices help to minimize the hazard of erosion.

Wildlife is mostly deer, turkey, grouse, and elk.

## Descriptions of the Soils

This section describes the soil series and mapping units in the Santa Fe Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series is true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Unless otherwise specified, all color and consistence terms used in soil descriptions are for the dry con-

dition. Reaction (pH) is by field indicator for a dilution of about one part soil to five parts indicator solution. The thickness variation given at the end of a horizon description is for profiles in the survey area.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock slides and Rough broken land, for example, do not belong to a soil series but nevertheless are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability subclass or unit, the range site, the timber suitability group, and the wildlife habitat group, in which the mapping unit has been placed. The page for the description of each capability subclass or unit, range site, timber suitability group, or wildlife habitat group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

Included soils are listed in the mapping units in the order of their extent.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (9).

### Adel Series

The Adel series consists of well-drained soils that formed in mixed alluvium, mainly from granite, gneiss, and schist. They are in alluvial valleys and drainageways. Slopes are 5 to 35 percent. The vegetation is mostly white fir, Douglas-fir, and aspen that have an understory of mid grasses. Elevation ranges from 8,500 to 9,000 feet. The mean annual precipitation is 20 to 25 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 60 to 90 days. Associated soils are in the Bobtail, Mirabal, Supervisor, and Cundiyo series.

In a representative profile the surface layer is very dark gray loam about 19 inches thick. The substratum is dark grayish-brown loam to a depth of 60 inches or more. The soil material is noncalcareous, and it is neutral in reaction throughout.

Adel soils are used for timber, as wildlife habitat, and for water supply.

Representative profile of Adel loam, 5 to 35 percent slopes, about 2½ miles northwest of the Santa Fe Ski Lodge, NE¼SW¼ sec. 1, T. 18 N., R. 10 E.:

- A1—0 to 19 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine tubular pores; neutral (pH 6.6); clear, smooth boundary. 10 to 30 inches thick.
- C—19 to 60 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, very friable when moist, nonsticky and nonplastic when wet; few fine and common medium roots; common fine tubular pores; neutral (pH 6.6).

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	High intensity		Low intensity	
	Acres	Percent	Acres	Percent
Adel loam, 5 to 35 percent slopes.....			1, 082	0. 1
Agua Fria fine sandy loam.....			7, 904	. 6
Alluvial land, cobbly.....			2, 853	. 2
Alluvial land, gravelly.....			883	. 1
Alluvial land, saline.....			6, 231	. 5
Ancho clay loam.....	364	( <sup>1</sup> )		
Ancho clay loam, saline.....	290	( <sup>1</sup> )		
Apache stony fine sandy loam, 1 to 15 percent slopes.....			14, 577	1. 2
Badland.....			2, 300	. 2
Basalt rock land.....			11, 112	. 9
Bluewing loamy fine sand.....	534	( <sup>1</sup> )		
Bluewing loamy fine sand, saline.....	352	( <sup>1</sup> )		
Bluewing gravelly sandy loam.....	1, 384	0. 1	4, 906	. 4
Bobtail loam, 20 to 70 percent slopes.....			7, 030	. 6
Bobtail-Rock outcrop complex, 40 to 90 percent slopes.....			3, 609	. 3
Borrogo loam, 10 to 30 percent slopes.....			2, 150	. 2
Calabasas loam, 0 to 10 percent slopes.....			17, 570	1. 4
Calabasas loam, 0 to 20 percent slopes, eroded.....			2, 622	. 2
Capillo gravelly sandy loam, 10 to 50 percent slopes.....			5, 347	. 4
Capillo-Rock outcrop complex, 25 to 70 percent slopes.....			3, 750	. 3
Cerrillos fine sandy loam, 0 to 5 percent slopes.....	2, 169	. 2	1, 658	. 1
Cerrillos fine sandy loam, 5 to 10 percent slopes.....	1, 046	. 1		
Chimayo stony loam, 30 to 60 percent slopes.....			31, 501	2. 5
Clovis loam, 1 to 3 percent slopes.....			22, 837	1. 8
Cueva very stony clay, 20 to 60 percent slopes.....			4, 093	. 3
Cundiyo gravelly sandy loam, 45 to 80 percent slopes.....			17, 694	1. 4
Dean-Pastura loams, 1 to 9 percent slopes.....			11, 290	. 9
El Rancho sandy clay loam, 0 to 1 percent slopes.....	341	( <sup>1</sup> )		
El Rancho sandy clay loam, 1 to 3 percent slopes.....	1, 938	. 2		
El Rancho sandy clay loam, 3 to 5 percent slopes.....	1, 174	. 1		
El Rancho sandy clay loam, sandy subsoil variant.....	353	( <sup>1</sup> )		
El Rancho-Fruitland complex.....			18, 349	1. 5
Encierro stony fine sandy loam, 0 to 20 percent slopes.....			3, 064	. 2
Fivemile loam.....	2, 982	. 2	16, 159	1. 3
Fortwingate gravelly sandy loam, loamy subsoil variant, 30 to 60 percent slopes.....			1, 425	. 1
Fruitland sandy loam, 0 to 3 percent slopes.....	298	( <sup>1</sup> )		
Fruitland sandy loam, 3 to 5 percent slopes.....	69	( <sup>1</sup> )		
Fruitland sandy loam, saline, 0 to 3 percent slopes.....	197	( <sup>1</sup> )		
Fruitland sandy clay loam, 0 to 3 percent slopes.....	940	. 1		
Galisteo-Gullied land complex, level.....			10, 288	. 8
Guaje gravelly sandy loam, 10 to 30 percent slopes.....			2, 826	. 2
Hagerman fine sandy loam, 0 to 5 percent slopes.....			6, 897	. 6
Harvey loam, 1 to 9 percent slopes.....			43, 637	3. 5
Harvey-Dean loams, 1 to 9 percent slopes.....			29, 283	2. 4
Harvey-Penistaja sandy loams, 0 to 5 percent slopes.....			14, 300	1. 2
Harvey-Cerrillos association, undulating.....			25, 235	2. 0
La Brier loam.....			13, 289	1. 1
La Fonda loam, 3 to 10 percent slopes.....	378	( <sup>1</sup> )		
Laporte-Rock outcrop complex, 5 to 25 percent slopes.....	1, 075	. 1	9, 534	. 8
Las Lucas loam, 1 to 9 percent slopes.....			27, 358	2. 2
Los Alamos-Silver sandy loams, 0 to 10 percent slopes.....			1, 119	. 1
Lunch peat, shallow variant.....			286	( <sup>1</sup> )
Majada stony fine sandy loam, 20 to 50 percent slopes.....			19, 063	1. 5
McVickers sandy loam, kaolinitic variant.....			780	. 1
Mirabal stony loam, 5 to 30 percent slopes.....			2, 414	. 2
Mirabal stony loam, 30 to 70 percent slopes.....			26, 735	2. 2
Mirabal-Rock outcrop complex, 40 to 100 percent slopes.....			7, 869	. 6
Montoso gravelly silt loam, 5 to 30 percent slopes.....			2, 095	. 2
Montoso gravelly silt loam, 30 to 60 percent slopes.....			8, 168	. 7
Moriarty silty clay.....			5, 178	. 4
Nambe gravelly loam, 30 to 50 percent slopes.....			13, 088	1. 1
Nambe stony loam, 20 to 60 percent slopes.....			13, 812	1. 1
Nambe stony loam, 20 to 70 percent slopes, eroded.....			4, 567	. 4
Nambe-Rock outcrop complex, 20 to 50 percent slopes.....			2, 340	. 2
Nambe-Rock outcrop complex, 50 to 100 percent slopes.....			3, 125	. 3
Ortiz gravelly loam, 5 to 40 percent slopes.....			2, 293	. 2
Otero-Palma fine sandy loams, 1 to 9 percent slopes.....			13, 597	1. 1
Panky fine sandy loam.....	9, 085	. 7	46, 562	3. 8
Pena stony clay loam, 1 to 25 percent slopes.....			13, 414	1. 1
Penistaja fine sandy loam, 0 to 5 percent slopes.....			14, 619	1. 2

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils—Continued*

Soil	High intensity		Low intensity	
	Acres	Percent	Acres	Percent
Penitente cobbly loam, 0 to 30 percent slopes			515	(1)
Persayo-Shale rock land association, rolling			5,391	0.4
Pojoaque-Panky association, rolling			26,219	2.1
Pojoaque-Rough broken land complex	12,869	1.1	88,594	7.2
Prewitt loam			8,563	.7
Rednun loam, 1 to 9 percent slopes			31,779	2.6
Rednun-Pena association, rolling			27,763	2.2
Rednun-Travessilla association, undulating			5,090	.4
Riverwash			4,577	.4
Rock outcrop			7,286	.6
Rock outcrop-Chimayo complex, 45 to 100 percent slopes			22,186	1.8
Rock slides			1,396	.1
Rough broken land			29,077	2.3
Santa Fe-La Fonda association, hilly			7,993	.7
Santa Fe-Rock outcrop complex, 5 to 25 percent slopes	3,143	.3	6,761	.6
Silver-Pojoaque association, undulating			21,221	1.7
Silver loam, 0 to 10 percent slopes			12,698	1.0
Stony rock land			47,545	3.9
Supervisor gravelly sandy loam, 15 to 60 percent slopes			19,003	1.5
Supervisor-Rock outcrop complex, 45 to 100 percent slopes			2,084	.2
Tapia-Dean loams, 1 to 5 percent slopes			24,431	2.0
Travessilla-Bernal fine sandy loams			60,053	4.9
Travessilla-Rock outcrop complex, 1 to 25 percent slopes			45,240	3.7
Tuff rock land			14,837	1.2
Wilcoxson sandy clay loam, soft bedrock variant, 15 to 40 percent slopes			2,933	.2
Willard loam			2,047	.2
Witt loam			62,318	5.0
Zuni loam, brown subsoil variant, 10 to 40 percent slopes			2,269	.2
Water			403	(1)
Total	40,981	3.2	1,196,439	96.8

<sup>1</sup> Less than 0.1 percent.

In the A horizon value is 3 or 4 when dry and 2 or 3 when moist. Chroma ranges from 0 to 2. In the C horizon hue is 10YR or 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 0 to 2. Between depths of 10 and 40 inches texture is loam or light clay loam.

**Adel loam, 5 to 35 percent slopes (AD).**—This soil is gently rolling to steep. It is in the northeastern part of the survey area. Included in mapping were areas of soils that are somewhat poorly drained.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 9.5 to 11.0 inches.

This soil is used as timberland, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; timber suitability groups 2, 4, and 8; wildlife habitat group H.

### Agua Fria Series

The Agua Fria series consists of well-drained soils that formed in mixed old alluvium on terraces and alluvial fans. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses and shrubs. Elevation ranges from 6,600 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Panky, Cerrillos, and Pojoaque series.

In a representative profile the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is reddish-brown and light reddish-brown heavy clay loam about 11 inches thick. The substratum to a depth of about 30 inches is pink and light-brown clay loam and sandy loam that has a high content of lime. Below this, the substratum consists of gravel and cobblestones embedded in a high lime zone. The soil material is moderately alkaline to strongly alkaline. It is noncalcareous to a depth of 6 to 12 inches and calcareous below this depth.

Agua Fria soils are used for range, as wildlife habitat, for water supply, and, to a limited extent, for community development.

Representative profile of Agua Fria fine sandy loam, near the Santa Fe City Municipal Golf Course, at the junction of the Santa Fe River and the old Albuquerque Highway, SW $\frac{1}{4}$  sec. 9, T. 16 N., R. 8 E.:

A1—0 to 4 inches, brown (7.5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, thick, platy structure; soft, very friable when moist, slightly sticky and nonplastic when wet; few fine roots; common fine tubular pores; 5 to 15 percent igneous gravel; noncalcareous; moderately alkaline (pH 8.2); abrupt boundary. 3 to 6 inches thick.

B2t—4 to 10 inches, reddish-brown (5YR 5/4) heavy clay loam, reddish brown (5YR 4/4) when moist; moderate, coarse, prismatic structure and strong, fine to medium, angular and subangular blocky; hard, friable when moist, very sticky and very plastic when wet; few fine and very fine roots; common fine tubular pores; thin continuous clay films; non-

calcareous; moderately alkaline (pH 8.4); abrupt boundary. 3 to 8 inches thick.

B3ca—10 to 15 inches, light reddish-brown (5YR 6/3) heavy clay loam, reddish brown (5YR 5/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; common fine tubular pores; few insect casts; clay films in pores; slightly calcareous, disseminations and fine, irregular-shaped concretions of lime; strongly alkaline (pH 8.6); clear boundary. 3 to 5 inches thick.

C1ca—15 to 21 inches, pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; few fine roots; common fine tubular pores; strongly calcareous, disseminations of lime; strongly alkaline (pH 8.8); clear boundary. 4 to 6 inches thick.

IIC2—21 to 30 inches, light-brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine tubular pores; slightly calcareous, few concretions of lime; strongly alkaline (pH 8.6); abrupt boundary. 5 to 11 inches thick.

IIIC3—30 to 60 inches, gravel and cobblestones in a limy matrix.

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B2t horizon ranges from heavy clay loam to light clay. In the C1ca horizon hue is 7.5YR or 5YR, and value ranges from 6 to 8 when dry or is 5 or 6 when moist. Chroma is 3 or 4. The content of calcium carbonate is less than 15 percent. Depth to gravel and cobblestones is 18 to 36 inches but is generally about 30 inches. The gravel and cobblestones are generally embedded in a discontinuous zone of lime.

**Agua Fria fine sandy loam** (0 to 5 percent slopes) (AF).—This soil is level to gently sloping. It is only in the vicinity of the city of Santa Fe and on sides of the Ortiz Mountains. Included in mapping were areas of Cerrillos, Fivemile, and Panky soils.

Permeability is moderately slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 18 to 36 inches. Available water holding capacity is 4.5 to 5.5 inches.

This soil is used for range, as wildlife habitat, for water supply, and, to a limited extent, for community development. Dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

## Alluvial Land

Alluvial land is a miscellaneous land type that consists of areas of unconsolidated, recently deposited alluvium. The sediment is stratified and varies widely in texture. It is subject to frequent changes as a result of stream overflow. Pockets and strata of coarse fragments are common.

Alluvial land is scattered throughout the Area, but the largest acreage is along flood plains of the Galisteo Creek. It is nearly level to strongly sloping.

**Alluvial land, cobbly** (0 to 10 percent slopes) (AL).—This land type consists of highly stratified, dark, medium textured to moderately coarse textured sediment along narrow drainageways. Gravel, cobblestones, and stones are very common. This land type is level to strongly sloping and is only in the northeastern part of the survey area. Elevation ranges from 7,700 to 9,500 feet. This land type floods in places because of intense summer storms of short duration and melting snow in spring. Seeps and springs are

common. Several live and intermittent streams are in the narrow alluvial bottoms. In places where the water table is high, this land type produces large, dense stands of trees.

Included with this land type in mapping were areas where slopes are 10 to 25 percent.

Permeability is moderately rapid in the soil material of this land type. Runoff is medium. The hazard of erosion is moderate.

Areas of this land type are used for timber production, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; timber suitability groups 2, 5, and 9; wildlife habitat group G.

**Alluvial land, gravelly** (0 to 10 percent slopes) (AG).—This land type consists of highly stratified, dark, medium textured to moderately coarse textured sediment along narrow drainageways. Gravel, cobblestones, and stones are very common. This land type is level to strongly sloping and is only in the northeastern part of the survey area. Elevation ranges from 7,000 to 8,500 feet.

Included with this land type in mapping were areas of exposed bedrock, ponds, and thick deposits along toe slopes. Also included were areas where slopes are 10 to 25 percent.

Permeability is moderately rapid in the soil material of this land type. Runoff is medium. The hazard of erosion is moderate.

Areas of this land type are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; Mountain Valley range site; wildlife habitat group F.

**Alluvial land, saline** (0 to 3 percent slopes) (AM).—This land type consists of highly stratified material that ranges from loamy sand to silty clay loam. The material ranges from slightly to strongly saline, and it is always sufficiently saline to affect the kinds and amount of vegetation that will grow. This land type is level to nearly level and is only in the central part of the Area within the Galisteo Creek drainage basin. Elevation ranges from 6,200 to 6,600 feet.

Included with this land type in mapping were areas of Galisteo and Prewitt soils and small acreages of other soils.

The hazard of gully erosion is severe. Vertically walled gullies 10 to 40 feet deep restrict the movement of livestock.

Areas of this land type are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; Salt Flats range site; wildlife habitat group F.

## Ancho Series

The Ancho series consists of well-drained soils that formed in mixed alluvium from the Santa Fe formation and granitic material on flood plains and terraces. Slopes are 0 to 3 percent. The vegetation is mostly mid grasses, but where these soils are irrigated, mostly alfalfa and orchards are grown. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Pojoaque, El Rancho, and Fruitland series.

In a representative profile the surface layer is brown clay loam about 16 inches thick. The substratum is pinkish-gray clay loam that contains some free lime to a depth of



60 inches or more. The soil material is moderately alkaline to strongly alkaline, and it is calcareous throughout.

Ancho soils are used for irrigated crops, as wildlife habitat, and for water supply.

Representative profile of Ancho clay loam,  $\frac{1}{4}$  mile south of Nambe School, in the center of sec. 9, T. 19 N., R. 9 E.:

A11—0 to 10 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common fine and few medium roots; few fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 6 to 12 inches thick.

A12—10 to 16 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common fine and medium roots; few fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 8 inches thick.

C—16 to 60 inches, pinkish-gray (7.5YR 6/2) clay loam, dark brown (7.5YR 4/2) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; very few fine roots; few fine tubular pores; slightly calcareous; strongly alkaline (pH 9.0).

In the A horizon chroma is 2 or 3. In the C horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. Between depths of 10 and 40 inches texture ranges from clay loam to silty clay loam. The soil is generally calcareous throughout, but small areas are free of lime to a depth of a few inches.

**Ancho clay loam** (0 to 3 percent slopes) (An).—This soil is level to nearly level. It is in the northern part of the survey area. This soil has the profile described as representative for the Ancho series.

Included with this soil in mapping were areas of El Rancho and Fruitland soils. In a few acres slopes are as much as 9 percent.

Permeability is moderately slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 60 inches or more. Available water holding capacity is 11 to 12.5 inches.

This soil is used for irrigated crops, for range, as wildlife habitat, and for water supply. Alfalfa and orchards are the crops most commonly grown under irrigation. Irrigated capability unit IIe-1; wildlife habitat group I.

**Ancho clay loam, saline** (0 to 3 percent slopes) (Ao).—This soil is level to nearly level. It is in the northern part of the survey area. The profile of this soil is similar to that described as representative for the series, except for a fluctuating water table, the presence of soluble salts, and an effective rooting depth that is restricted by the water table. Depth to water table ranges from 0 to more than 3 feet, depending on seasonal stream flow and local irrigation practices. Concentrations of salt range from slight to moderate. Permeability is moderately slow in this soil. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 4 to 5 inches.

Included with this soil in mapping were small areas of El Rancho sandy clay loam, 1 to 3 percent slopes. Where the unit is adjacent to the stream channel, small pockets of Bluewing loamy fine sand, saline, have also been included. A small area of clayey soils along the Rio Arriba County line (north of Santa Cruz) is included.

This soil is used for irrigated pasture, as wildlife habitat, and for water supply. Irrigated capability unit VIw-1; wildlife habitat group I.

## Apache Series

The Apache series consists of well-drained soils that formed in material weathered from basalt and other volcanic debris. Depth to bedrock is 11 to 20 inches. Slopes are 1 to 15 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Majada, Silver, and Calabasas series.

In a representative profile the surface layer is brown stony fine sandy loam about 9 inches thick. The substratum is light-brown sandy clay loam that has a high content of lime. Basalt bedrock is at a depth of about 16 inches. The soil material is calcareous and moderately alkaline to strongly alkaline.

Apache soils are used for range, as wildlife habitat, and for water supply. They are also a source of rock used for building and landscaping.

Representative profile of Apache stony fine sandy loam, 1 to 15 percent slope, 1.7 miles southwest of Colorado Peak on the Caja del Rio Grant, SE $\frac{1}{4}$  sec. 6, T. 16 N., R. 7 E.:

A11—0 to 3 inches, brown (10YR 5/3) stony fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; soft, friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; 30 percent stones; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 4 inches thick.

A12—3 to 9 inches, brown (10YR 5/3) stony fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; 20 percent cobblestones and stones; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 8 inches thick.

Cca—9 to 16 inches, light-brown (7.5YR 6/4) light sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine and medium roots; few fine tubular pores; 15 percent cobblestones and stones; strongly calcareous; strongly alkaline (pH 8.6); abrupt boundary. 5 to 8 inches thick.

R—16 inches, fractured basalt bedrock; fractures filled with white (10YR 8/2) carbonate material.

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the Cca horizon hue ranges from 10YR to 7.5YR, and value ranges from 4 to 6 when dry and from 3 to 5 when moist. Chroma is 3 or 4. The Cca horizon ranges from light clay loam to light sandy clay loam. The content of coarse fragments in the Cca horizon is from 10 to 25 percent. Depth to basalt is 11 to 20 inches.

**Apache stony fine sandy loam, 1 to 15 percent slopes** (AP).—This soil is nearly level to strongly sloping. It is in the northwestern part of the survey area. Included in mapping were areas of Majada and Silver soils and basalt outcroppings.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 11 to 20 inches. Available water holding capacity is 1.5 to 3 inches.

This soil is used for range, as wildlife habitat, and for water supply. It is also a source of rock used for landscaping. Dryland capability subclass VII<sub>s</sub>; Malpais range site; wildlife habitat group F.

## Badland

Badland (BA) is steep to very steep, nearly barren land. Numerous intermittent drainage channels are in the areas. Slopes are 30 to 75 percent. Badland is in the northern one-third of the survey area. Geological erosion is severe, but sandstone covers the areas where this land type is less sloping and slows down the erosional processes. Areas not covered by sandstone have more of a rounded appearance because the erosional processes have accelerated and, in places, have caused steep spiral-like configurations. Relief of the area ranges from 50 to 200 feet above the surrounding terrain. The toe slopes of the steeper ridges and vertical cliffs consist of deep loamy sands and sands that are severely gullied.

Included with this land type in mapping were areas of Rough broken land and a few acres of Bluewing and Fruitland soils. These inclusions make up about 5 percent of the mapped areas.

This land type is unsuited to farming. It is used for water supply and scenic purposes and, to a very limited extent, as wildlife habitat. Dryland capability subclass VIIIe.

## Basalt Rock Land

Basalt rock land (BD) is a very steep land type in the northwestern part of the Santa Fe Area. The mapped areas are about 50 percent basalt rock outcrops and basalt boulders. In places, where this land type is less sloping, are small benchlike areas. These areas formed as a result of slipping and falling basalt boulders that became lodged and partly stabilized. Slopes are 50 to 90 percent.

This land type is not suitable for use by domestic livestock because of slope and extensive areas of exposed rock, cliffs, and ledges. Although a large amount of forage grows on this land type, it is mainly used as wildlife habitat. Runoff from this land type during and after heavy rains provides large amounts of water to areas below. Dryland capability subclass VIIIi; wildlife habitat group F.

## Bernal Series

The Bernal series consists of well-drained soils that formed in material weathered from sandstone. Depth to sandstone is 8 to 20 inches. Slopes are 1 to 5 percent. The vegetation is mostly mid grasses and trees. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Travessilla, Hagerman, and Penistaja series. Bernal soils are not mapped separately in the Area. They are mapped only in complex with Travessilla soils.

In a representative profile the surface layer is brown fine sandy loam about 3 inches thick. The subsoil is reddish-brown very fine sandy loam and clay loam about 15 inches thick. Sandstone is at a depth of about 18 inches. The soil material is noncalcareous, and reaction is neutral.

Bernal soils are used for range, as wildlife habitat, and for water supply. Some flagstone is mined, and the pinyon and juniper are used for firewood and fenceposts.

Representative profile of Bernal fine sandy loam in an

area of Travessilla-Bernal fine sandy loams, 5 miles south and 2 miles west of Ojo de La Vaca, in the unsectioned San Cristoval Grant, 2 miles east on U.S. Route No. 285:

A1—0 to 3 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 3/3) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; common medium and fine roots; very few very fine tubular pores; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 4 inches thick.

B1—3 to 7 inches, reddish-brown (5YR 4/3) very fine sandy loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; very few very fine tubular pores; thin patchy clay films; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 4 inches thick.

B2t—7 to 18 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; strong, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; very few very fine roots; very few very fine tubular pores; thin patchy clay films; noncalcareous; neutral (pH 7.2); clear boundary. 4 to 12 inches thick.

R—18 inches, reddish sandstone.

In the A horizon value is 4 or 5 when dry and 2 to 3.5 when moist. Chroma is 2 to 3. In the B2t horizon hue is 7.5YR or 5YR, and value ranges from 4 to 6 when dry and from 3 to 5 when moist. Chroma is 2 or 3. The B2t horizon ranges from sandy clay loam to clay loam. Depth to sandstone is 8 to 20 inches. In places the soil material immediately above the sandstone is slightly calcareous.

## Bluewing Series

The Bluewing series consists of excessively drained soils on terraces. They formed in recent alluvium of mixed origin. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,400 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Fivemile and Pojoaque series.

In a representative profile the surface layer is grayish-brown gravelly sandy loam about 4 inches thick. The next layer is brown gravelly loam about 16 inches thick. The substratum is pinkish-gray very gravelly fine sand. The soil material is mildly alkaline to moderately alkaline. It is noncalcareous to a depth of 2 to 6 inches, and calcareous below this depth.

Bluewing soils are used for range, as wildlife habitat, and for water supply. They are also a good source of building sand.

Representative profile of Bluewing gravelly sandy loam, about 8 miles northwest of Santa Fe, along the Caja del Rio Grant line, SE $\frac{1}{4}$  sec. 20, T. 18 N., R. 8 E.:

A1—0 to 4 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; very few very fine roots; about 40 percent igneous gravel; noncalcareous; mildly alkaline (pH 7.8); abrupt boundary. 2 to 6 inches thick.

AC—4 to 20 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) when moist; massive; hard, friable when moist, slightly sticky and nonplastic when wet; about 20 percent igneous gravel; strongly calcareous; mildly alkaline (pH 7.8); clear boundary. 12 to 18 inches thick.

IIC—20 to 60 inches, pinkish-gray (7.5YR 6/2) very gravelly

fine sand, dark brown (7.5YR 4/2) when moist; single grained; loose, dry and moist, nonsticky and nonplastic when wet; about 75 percent igneous gravel; strongly calcareous; moderately alkaline (pH 8.1).

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. In the AC horizon hue is 7.5YR or 10YR, and value is 5 to 6 when dry and 3 or 4 when moist. Chroma is 2 to 3. In the IIC horizon hue is 7.5YR and 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 2 or 3. Between depths of 10 and 40 inches the texture generally ranges from very gravelly loamy sand to very gravelly coarse sand. The content of coarse fragments ranges from 50 to 75 percent.

The soils mapped in the survey area as Bluewing include hues of 7.5YR, which are outside the range for the Bluewing series. Also, these soils occur under conditions of higher rainfall and at higher elevations than are normal for the series. These differences, however, do not alter the usefulness or behavior of the soils.

**Bluewing gravelly sandy loam** (0 to 5 percent slopes) (Bg) (BH).—This soil is level to gently sloping. It is mostly in the northern part of the survey area. It is mapped at both high and low intensity, but it is mainly in the low-intensity area. This soil has the profile described as representative for the series. Included in mapping were areas of Fivemile soils and of clean river sand.

Permeability in this soil is rapid. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 3 to 4 inches.

This soil is used for range, as wildlife habitat, and for water supply. It is also a good source of building sand. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

**Bluewing loamy fine sand** (0 to 3 percent slopes) (Be).—This soil is level to nearly level. It is in the northern part of the survey area. This soil has a profile similar to that described as representative for the series, except that it has a surface layer of loamy fine sand and has less coarse fragments in the upper part of the substratum. Included in mapping were areas of Fruitland and El Rancho soils.

Permeability is rapid in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 3 to 4 inches.

This soil is used for irrigated crops, as wildlife habitat, and for water supply. Irrigated capability unit IVE-1; wildlife habitat group J.

**Bluewing loamy fine sand, saline** (0 to 3 percent slopes) (Bf).—This soil is level to nearly level. It is in the northern part of the survey area. This soil has a profile similar to that described as representative for the series, except that it has a fluctuating water table and is saline.

Included with this soil in mapping were small areas of Fruitland sandy loam, saline, 0 to 3 percent slopes, and El Rancho sandy clay loam, 1 to 3 percent slopes.

Permeability is rapid. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 25 to 35 inches. Available water holding capacity is 2 to 3 inches. The depth to the water table varies because of seasonal stream flow and local irrigation practices but ranges in depth from 0 to 36 inches. Concentrations of salt range from slight to moderate.

This soil is used for irrigated pasture, as wildlife habitat, and for water supply. Irrigated capability unit VIw-1; wildlife habitat group J.

## Bobtail Series

The Bobtail series consists of well-drained soils that formed in material on mountain slopes derived from granite, gneiss, and schist. Depth to bedrock is 20 to 40 inches. Slopes are 20 to 90 percent. The vegetation is mostly aspen, but some conifers, forbs, and scattered mid grasses are present. Elevation ranges from 10,000 to 10,500 feet. The mean annual precipitation is 28 to 31 inches, and the mean annual air temperature is 41° to 43° F. The frost-free season is 60 to 80 days. Associated soils are in the Cundiyo, Supervisor, and Nambe series.

In a representative profile the surface layer is light brownish-gray loam about 10 inches thick. The subsoil is pale-brown stony loam about 11 inches thick. The substratum is pale-brown stony loam. It is underlain by gneiss bedrock at a depth of about 36 inches. The soil material is very strongly acid.

Bobtail soils are used for timber, recreation, as wildlife habitat, and for water supply.

Representative profile of Bobtail loam, 20 to 70 percent slopes, northwest of the Sante Fe Ski Basin in Santa Fe County, SE¼SE¼ sec. 7, T. 18 N., R. 11 E.:

O1 & O2—2 inches to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.

A2—0 to ½ inch, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine vesicular pores; very strongly acid (pH 4.8); abrupt boundary. ½ to 2 inches thick.

B2ir—½ to 1½ inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 4/3) when moist; weak, fine, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine tubular pores; very strongly acid (pH 4.8); abrupt boundary. 1 to 3 inches thick.

A21—1½ to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure and moderate, fine, crumb; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and common medium roots; common fine tubular pores; moderate amount of mica; bleached and clear surfaces on sand grains; very strongly acid (pH 4.8); clear boundary. 7 to 12 inches thick.

B2—10 to 21 inches, pale-brown (10YR 6/3) stony loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common medium and coarse roots; common fine tubular pores; reddish-brown seams and stains of iron oxide; about 35 percent stones; very strongly acid (pH 5.0); gradual boundary. 9 to 13 inches thick.

C—21 to 36 inches, pale-brown (10YR 6/3) stony loam, brown (10YR 5/3) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few medium and coarse roots; few fine and medium tubular pores; about 30 percent stones; very strongly acid (pH 5.0); clear boundary. 3 to 20 inches thick.

R—36 inches, gneiss bedrock.

In the A2 horizon value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 2 or 3. In the B2ir horizon hue ranges from 5YR to 10YR, and value is 5 or 6 when dry and ranges from 3 to 5 when moist. Chroma ranges from 2 to 4. In the B2 horizon variegated colors are common. In the C horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 5 or 6 when moist. Chroma ranges from 2 to 4. Depth to bedrock is 20 to 40 inches.

**Bobtail loam, 20 to 70 percent slopes** (BM).—This soil is moderately steep to very steep. It is in the northeastern part of the survey area. This soil has the profile described

as representative for the series. Included in mapping were areas of Cundiyo and Nambe soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is 20 to 40 inches. Available water holding capacity is 2.5 to 5 inches.

This soil is used for timber production, for recreation, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; timber suitability groups 4, 7, and 11; wildlife habitat group G.

**Bobtail-Rock outcrop complex, 40 to 90 percent slopes (BO).**—This complex consists of about 60 percent Bobtail loam and about 25 percent Rock outcrop. Included soils make up the other 15 percent. These are Cundiyo, Supervisor, and Nambe soils. The Bobtail soils are steep to very steep and are intermingled with the Rock outcrop.

The Bobtail soil has a profile similar to that described as representative for the Bobtail series, except that it is about 30 inches deep to bedrock. Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 35 inches. Available water holding capacity is 2.5 to 4 inches.

The soils in this complex are used for timber production, as wildlife habitat, for water supply, and, to a limited extent, for range. Dryland capability subclass VIIi; timber suitability groups 6, 9 and 12; wildlife habitat Group G.

## Borrogo Series

The Borrogo series consists of well-drained soils that formed on uplands in material weathered from granite and gneiss. Depth to bedrock is 14 to 20 inches. Slopes are 10 to 30 percent. The vegetation is mostly mid grasses, forbs, ponderosa pine, and a few junipers. Elevation ranges from 8,000 to 9,000 feet. The mean annual precipitation is 17 to 19 inches, and the mean annual air temperature is 43° to 45° F. The frost-free season is 70 days to 100 days. Associated soils are in the Chimayo, Mirabal, Supervisor, and Wilcoxson variant series.

In a representative profile the surface layer is grayish-brown loam about 3 inches thick. The subsoil is brown and light yellowish-brown heavy clay loam, gravelly clay, and gravelly sandy clay loam about 15 inches thick. It is underlain by fractured granite at a depth of about 18 inches. The soil material is neutral in reaction.

Borrogo soils are used as timberland, as wildlife habitat, and for water supply.

Representative profile of Borrogo loam, 10 to 30 percent slopes, about 5 miles northeast of Cundiyo,  $\frac{1}{4}$  mile south of the Rio Arriba County line, NW $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 5, T. 20 N., R. 11 E.:

- O1 & O2—1 inch to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.
- A2—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, thin, platy structure and moderate, fine, crumb; soft, friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; many fine tubular pores; neutral (pH 6.8); abrupt boundary. 2 to 4 inches thick.
- B2t—3 to 6 inches, brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) when moist; moderate, fine and medium, angular blocky structure; extremely hard, firm when moist and sticky and plastic when wet; many fine and medium roots; few fine tubular pores;

few thin clay films; neutral (pH 7.2); clear boundary. 3 to 6 inches thick.

- B22—6 to 13 inches, brown (7.5YR 5/4) fine gravelly clay, dark brown (7.5YR 4/4) when moist; strong, fine and medium, angular blocky structure; extremely hard, firm when moist and very sticky and very plastic when wet; few medium roots; few fine tubular pores; few thin clay films; about 15 percent fine granitic gravel; neutral (pH 7.2); clear boundary. 5 to 9 inches thick.

- B3—13 to 18 inches, light yellowish-brown (10YR 6/4) gravelly sandy clay loam, strong brown (7.5YR 5/6) when moist; weak, fine and medium, angular blocky structure; very hard, firm when moist, sticky and plastic when wet; few fine roots; few very fine tubular pores; about 20 percent fine granitic gravel; neutral (pH 6.8); clear boundary. 4 to 6 inches thick.

- R—18 inches, granite bedrock.

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 to 3. In the B2t horizon hue ranges from 10YR to 7.5YR, and value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 to 4. The Bt2 horizons range from a heavy clay loam to clay or gravelly clay. In the B3 horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 5 or 6 when moist. Chroma ranges from 4 to 6. The content of gravel ranges from about 15 percent in the A horizon to 15 to 30 percent in the B2t horizon. In places stones are on the surface.

**Borrogo loam, 10 to 30 percent slopes (BR).**—This soil is strongly sloping to moderately steep. It is in the north-eastern part of the survey area. Included in mapping were areas of Wilcoxson variant, Zuni variant, and Mirabal soils.

Permeability is very slow in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 14 to 20 inches. Available water holding capacity is 1.5 to 2.5 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability group 3; wildlife habitat group H.

## Calabasas Series

The Calabasas series consists of well-drained soils that formed in material weathered from basalt and windlaid deposits of volcanic debris on piedmont slopes and fans. Slopes are 0 to 20 percent. The vegetation is mid grasses and scattered shrubs. Elevation ranges from 6,400 to 7,000 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Silver, Panky, and Apache series.

In a representative profile the surface layer is brown loam about 11 inches thick. The subsoil is pinkish-gray and light-brown heavy loam and light clay loam about 33 inches thick. The substratum is very pale brown and pinkish-white gravelly loam to a depth of 60 inches or more. The soil material is mildly alkaline to moderately alkaline. It is noncalcareous to a depth of 3 to 12 inches and calcareous below this depth.

Calabasas soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Calabasas loam, 0 to 10 percent slopes, in the unsectioned La Majada Grant, about 2 miles south of Tetilla Peak:

- A1—0 to 11 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure and weak, medium, granular; soft, very friable when moist, nonsticky and nonplastic

when wet; many fine roots; many fine tubular pores; noncalcareous; mildly alkaline (pH 7.6); clear boundary. 3 to 12 inches thick.

B21—11 to 21 inches, pinkish-gray (7.5YR 6/2) heavy loam, brown (7.5YR 4/2) when moist; moderate, medium, angular and subangular blocky structure; extremely hard, firm when moist and slightly sticky and slightly plastic when wet; few very fine roots; many very fine tubular pores; few concretions of calcium carbonate; strongly calcareous; moderately alkaline (pH 8.2); gradual boundary. 4 to 12 inches thick.

B22—21 to 32 inches, pinkish-gray (7.5YR 7/2) light clay loam, brown (7.5YR 5/2) when moist; moderate, medium, subangular and angular blocky structure; extremely hard, firm when moist, slightly sticky and plastic when wet; few very fine roots; common very fine tubular pores; few, medium, prominent concretions of lime; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 12 inches thick.

B3—32 to 44 inches, light-brown (7.5YR 6/4) heavy loam, brown (7.5YR 5/4) when moist; weak, coarse, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few very fine tubular pores; medium, prominent lime nodules; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 12 inches thick.

C1—44 to 53 inches, very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) when moist; massive; slightly hard, friable when moist and nonsticky and nonplastic when wet; no roots; few very fine tubular pores; about 15 percent fine gravel; strongly calcareous; moderately alkaline (pH 8.2); abrupt boundary. 5 to 11 inches thick.

C2—53 to 60 inches, pinkish-white (7.5YR 8/2) gravelly loam, pinkish gray (7.5YR 7/2) when moist; massive; very hard, friable when moist and nonsticky and nonplastic when wet; few very fine tubular pores; about 15 percent fine gravel; strongly calcareous; lime mostly disseminated but some in thin to medium plates that are somewhat harder than soil masses when moist; moderately alkaline (pH 8.2).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. In the B horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the C horizon hue is 7.5YR or 10YR, and value is 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. In the C2 horizon gravel is 5 to 20 percent gravel. Depth to accumulated carbonate is 10 to 30 inches.

**Calabasas loam, 0 to 10 percent slopes (CA).**—This soil is level to strongly sloping. It is in the north-central part of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Silver, Apache, and Majada soils.

Permeability in this soil is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Effective rooting depth is 60 inches or more. Available water holding capacity is 9.5 to 11 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

**Calabasas loam, 0 to 20 percent slopes, eroded (CB).**—This soil is level to moderately steep. It is in the north-western part of the survey area. This soil is eroded, but the profile is otherwise similar to that described as representative for the series. Erosion has resulted in deep V-shaped gullies and, in places, windblown hummocky areas and small blowout areas. Included in mapping, and making up about 5 percent of the areas, is undifferentiated alluvium that is very stony.

Permeability is moderate in this soil. Runoff is slow to rapid, and the hazard of erosion is moderate to severe.

Effective rooting depth is 60 inches or more. Available water holding capacity is 9.5 to 11 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; Loamy range site; wildlife habitat group B.

## Capillo Series

The Capillo series consists of well-drained soils that formed on sides of mountains in material weathered from shale and limestone. Slopes are 10 to 70 percent. The vegetation is mostly ponderosa pine, Douglas-fir, white fir, shrubs, and mid grasses. Elevation ranges from 8,000 to 11,000 feet. The mean annual precipitation is 18 to 20 inches, and the mean annual air temperature is 43° to 45° F. The frost-free season is 50 to 100 days. Associated soils are in the Cueva, Encierro, Fortwingate variant, and McVickers variant series.

In a representative profile the surface layer is dark reddish-gray and reddish-gray gravelly sandy loam and sandy clay loam about 11 inches thick. The subsoil is reddish-gray sandy clay loam and reddish-brown clay and gravelly clay to a depth of 60 inches or more. The soil material is noncalcareous and is neutral in reaction.

Capillo soils are used as timberland, as wildlife habitat, and for water supply.

Representative profile of Capillo gravelly sandy loam, 10 to 50 percent slopes, 5 miles north and 1 mile east of Glorieta, along the road to Glorieta Baldy, SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 35, T. 17 N., R. 11 E.:

O1 & O2—2 inches to 0, needles, twigs, and cones in various stages of decomposition.

A1—0 to 7 inches, dark reddish-gray (5YR 4/2) gravelly sandy loam, dark reddish brown (5YR 3/2) when moist; weak, medium, platy structure; soft, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; common fine tubular pores; 15 percent gravel; noncalcareous; neutral (pH 6.6); clear boundary. 5 to 9 inches thick.

A3—7 to 11 inches, reddish-gray (5YR 5/2) sandy clay loam, dark reddish brown (5YR 3/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic; many fine and medium roots; common fine tubular pores; 5 percent gravel; noncalcareous; neutral (pH 6.6); clear boundary. 2 to 6 inches thick.

B1—11 to 15 inches, reddish-gray (5YR 5/2) sandy clay loam, dark reddish brown (5YR 3/2) when moist; weak, fine and medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine and medium roots; few fine tubular pores; 5 percent gravel; noncalcareous; neutral (pH 6.6); clear boundary. 2 to 6 inches thick.

B21t—15 to 27 inches, reddish-brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, angular and subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; few fine and medium roots; few fine tubular pores; continuous moderately thick clay films; noncalcareous; neutral (pH 6.8); clear boundary. 8 to 14 inches thick.

B22t—27 to 36 inches, reddish-brown (5YR 4/3) clay, reddish brown (5YR 3/3) when moist; moderate, fine and medium, angular and subangular blocky structure; very hard, firm when moist, slightly sticky and slightly plastic when wet; very few medium roots; few fine tubular pores; continuous moderately thick clay films; noncalcareous; neutral (pH 7.0); gradual boundary. 7 to 11 inches thick.

B3—36 to 60 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) when moist; moderate, fine, angular and subangular blocky structure; very

hard when dry, firm when moist, slightly sticky and slightly plastic when wet; very few medium roots; few fine tubular pores; 15 percent gravel; few thin clay films; noncalcareous; neutral (pH 7.0).

In the A horizon value is 4 or 5 when dry, and chroma is 1 or 2. In the B2t horizon value is 3 to 4 when moist, and chroma is 2 or 3. The B2t horizon ranges from heavy clay loam to clay. The B3 horizon ranges from noncalcareous to slightly calcareous. Gravel-sized fragments cover 15 to 50 percent of the surface. Depth to bedrock is more than 40 inches.

**Capillo gravelly sandy loam, 10 to 50 percent slopes (CC).**—This soil is strongly sloping to steep. It is in the northeastern part of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Cueva, McVickers variant, Fortwingate variant, and Supervisor soils.

Permeability is slow in this soil. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Effective rooting depth is 40 to 60 inches or more. Available water holding capacity is 7 to 8.5 inches.

This soil is used as timberland, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; timber suitability groups 2 and 5; wildlife habitat group G.

**Capillo-Rock outcrop complex, 25 to 70 percent slopes (CE).**—This complex consists of about 55 percent Capillo gravelly sandy loam and about 25 percent sandstone outcropping. The Capillo soil is moderately steep to very steep and is intermingled with sandstone outcrops. Included soils make up the other 20 percent. These are Cueva, McVickers variant, and Fortwingate variant soils and, to a lesser extent, Mirabal, Supervisor, and Cundiyo soils.

The Capillo soil has a profile similar to that described as representative for the series, except that the surface layer is about 5 inches thick and is underlain by sandstone at about 40 inches.

Permeability is slow in this soil. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 6 to 8 inches.

The soils in this complex are used as timberland, as wildlife habitat, and for water supply. Dryland capability subclass VIIs; timber suitability groups 3 and 6; wildlife habitat group G.

## Cerrillos Series

The Cerrillos series consists of well-drained soils that formed in mixed old alluvium on uplands. Slopes are 0 to 10 percent. The vegetation is mostly mid grasses and scattered shrubs and trees. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Panky, Agua Fria, and Pojoaque series.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The subsoil is reddish-brown heavy clay loam and clay loam about 8 inches thick. The substratum, to a depth of about 30 inches, is pinkish-white light clay loam that has a high content of lime. Below this, to a depth of 60 inches or more, it is reddish-yellow sandy clay loam. The soil material is moderately alkaline to strongly alkaline. It is noncalcareous to a depth of 6 to 11 inches and calcareous below this depth.

Cerrillos soils are used for range, for community development, as wildlife habitat, and for water supply.

Representative profile of Cerrillos fine sandy loam, 0 to 5 percent slopes, 2½ miles northwest of Galisteo, NE¼ sec. 21, T. 14 N., R. 9 E.:

A1—0 to 5 inches, brown (7.5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 3 to 6 inches thick.

B21t—5 to 9 inches, reddish-brown (5YR 4/4) heavy clay loam, reddish brown (5YR 4/4) when moist; strong, fine, subangular and angular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; few fine tubular pores; thin continuous clay films; noncalcareous; moderately alkaline (pH 8.4); clear boundary. 3 to 5 inches thick.

B22tca—9 to 13 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine and medium tubular pores; few thin clay films; disseminations of lime and fine, generally rounded concretions; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 9 inches thick.

C1ca—13 to 30 inches, pinkish-white (7.5YR 8/2) light clay loam, pink (7.5YR 7/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few very fine tubular pores; about 40 percent soft masses of calcium carbonate; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 12 to 24 inches thick.

C2—30 to 60 inches, reddish-yellow (5YR 6/6) sandy clay loam, reddish brown (5YR 5/4) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; very few very fine tubular pores; slightly calcareous; strongly alkaline (pH 8.8).

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. In the B2t horizon hue is 5YR or 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. The B21t horizon ranges from heavy clay loam to light clay. In the Cca horizon hue is 7.5YR or 5YR, and value ranges from 6 to 8 when dry and from 5 to 7 when moist. In the C horizon hue is 7.5YR or 5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Strata of sand and gravel are common below a depth of 30 inches.

**Cerrillos fine sandy loam, 0 to 5 percent slopes (Cf) (CG).**—The soil is level to gently sloping. It is in the central part of the survey area. This soil has the profile described as representative for the series. It is mapped at both high and low intensities, but it is mainly in the low-intensity area. Included in mapping were areas of Harvey, Panky, and Agua Fria soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth to the layer high in lime content is 10 to 20 inches. Available water holding capacity is 1.5 to 2.5 inches.

This soil is used for range, as wildlife habitat, for community development, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

**Cerrillos fine sandy loam, 5 to 10 percent slopes (Ch).**—This soil is moderately sloping to rolling. It is mapped only in the vicinity of the city of Santa Fe. Included in mapping were small areas of Panky fine sandy loam.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate to severe. Effective rooting depth to the layer high in content of lime is 10 to 20 inches. Available water holding capacity is 1.5 to 2.5 inches.



This soil is used for community development, for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

### Chimayo Series

The Chimayo series consists of well-drained soils on foothills and mountains. These soils formed in material weathered from granite, gneiss, and schist. Depth to bedrock is 12 to 20 inches. Slopes are 30 to 100 percent. The vegetation is mostly mid grasses, shrubs, and pinyon and juniper trees. Elevation ranges from 7,500 to 8,500 feet. The mean annual precipitation is 15 to 18 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Pojoaque, Supervisor, and Mirabal series.

In a representative profile the surface layer is grayish-brown stony loam about 6 inches thick. The substratum is light brownish-gray very stony loam about 14 inches thick. Interbedded granite, gneiss, and schist are at a depth of about 20 inches. The soil material is noncalcareous, and reaction is neutral.

Chimayo soils are used for range, as wildlife habitat, and for water supply. Pinyon and juniper trees are used for firewood and fenceposts.

Representative profile of Chimayo stony loam, 30 to 60 percent slopes, 2 miles northeast of Santa Fe, NE $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 3, T. 17 N., R. 10 E.:

O1 & O2—2 inches to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.

A1—0 to 6 inches, grayish-brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and medium roots; many medium tubular pores; about 20 percent stones; noncalcareous; neutral (pH 7.0); gradual boundary. 4 to 6 inches thick.

C—6 to 20 inches, light brownish-gray (10YR 6/2) very stony loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few fine and medium roots; many coarse and medium interstitial pores; about 60 percent stones, cobbles, and gravel; noncalcareous; neutral (pH 6.8); abrupt boundary. 8 to 14 inches thick.

R—20 inches, interbedded granite, gneiss, and schist.

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the C horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 2 or 3. Excluding the coarse fragments, the C horizon ranges from sandy loam to loam. The coarse fragments range from 55 to 65 percent, of which 20 percent is stones. Depth to bedrock ranges from 12 to 20 inches.

#### Chimayo stony loam, 30 to 60 percent slopes (CM).—

This soil is steep to very steep. It is on foothills and mountains in the central and northeastern part of the survey area. Included in mapping were areas of Mirabal, Supervisor, and Pojoaque soils and scattered areas where rocks crop out.

Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth is 12 to 20 inches. Available water holding capacity is 1 to 2 inches.

This soil is used for range, as wildlife habitat, and for water supply. Pinyon and juniper are used for firewood and fenceposts. Dryland capability subclass VIIe; Mountain Shale range site; wildlife habitat group F.

### Clovis Series

The Clovis series consists of well-drained soils that formed in mixed old alluvium on upland alluvial fans. Slopes are 1 to 3 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Harvey, Witt, and La Brier series.

In a representative profile the surface layer is brown loam about 4 inches thick. The subsoil is reddish-brown, brown, and light-brown sandy clay loam and clay loam about 25 inches thick. The substratum is light-brown sandy clay loam to a depth of about 34 inches. Below this, it is pinkish-white fine sandy loam. The substratum has a very high content of lime. The soil material is moderately alkaline. It is noncalcareous to a depth of 10 to 20 inches and calcareous below this depth.

Clovis soils are used for range, for irrigated crops, as wildlife habitat, and for water supply.

Representative profile of Clovis loam, 1 to 3 percent slopes, 4 $\frac{1}{2}$  miles north of Stanley,  $\frac{1}{4}$  mile south of the intersection of a county road and State Route No. 41 and 70 yards east of yellow marker, NW $\frac{1}{4}$  sec. 2, T. 11 N., R. 9 E.:

A1—0 to 4 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, very fine, granular structure; soft, very friable when moist, slightly sticky and nonplastic when wet; common fine roots; few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 6 inches thick.

B1—4 to 9 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; few thin, discontinuous clay films; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 3 to 6 inches thick.

B21t—9 to 15 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few very fine and fine tubular pores; few, thin, discontinuous clay films; slightly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 8 inches thick.

B22t—15 to 20 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; few, thin, discontinuous clay films; few concretions of calcium carbonate; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 8 inches thick.

B3ca—20 to 29 inches, light-brown (7.5YR 6/4) sandy clay loam, strong brown (7.5YR 5/6) when moist; moderate, medium, subangular blocky structure; hard, firm when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; common calcium carbonate nodules; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 8 to 12 inches thick.

C1ca—29 to 34 inches, light-brown (7.5YR 6/4) sandy clay loam, strong brown (7.5YR 5/6) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; disseminations of lime and few concretions and soft masses of calcium carbonate; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 8 inches thick.

C2ca—34 to 60 inches, pinkish-white (7.5YR 8/2) fine sandy



loam, pink (7.5YR 7/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; very few fine roots in upper part; very few fine tubular pores; common concretions of calcium carbonate and disseminations of lime; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. In the B2t horizon hue is 7.5YR or 5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. The B2t horizon ranges from sandy clay loam to clay loam. Depth to the Cca horizon is 20 to 36 inches.

**Clovis loam, 1 to 3 percent slopes (CO).**—This soil is nearly level. It is in the southern part of the survey area. Included in mapping were areas of Witt, Harvey, Tapia, Dean, and Apache soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 36 inches. Available water holding capacity is 5 to 6.5 inches.

This soil is used for range, for irrigated crops, as wildlife habitat, and for water supply. It was once one of the major dryfarmed soils in the survey area. Nearly all of the acreage has been planted to grass, the original cover. The few acres still farmed are planted mostly to small grain and are in the foothills of the San Pedro Mountains, where precipitation is somewhat higher. In Torrance County, which is south of this area, this soil receives more precipitation and is in Capability Class IV. Dryfarming is more prevalent in the Torrance County areas. Irrigated capability unit IIe-1; dryland capability subclass VIe; Loamy range site; wildlife habitat group E.

## Cueva Series

The Cueva series consists of well-drained soils on mountains. Depth to shale and sandstone is 20 to 48 inches. Slopes are 20 to 60 percent. The vegetation is mostly mid grasses, shrubs, and pinyon and juniper trees. Elevation ranges from 7,000 to 8,000 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 120 to 130 days. Associated soils are in the Moriarty, Wilcoxson variant, Encierro, and Rednun series.

In a representative profile the surface layer is dusky red very stony light clay about 3 inches thick. The subsoil is a dusky red clay about 16 inches thick. The substratum is weak-red and pinkish-gray silty clay loam. Depth to underlying shale or sandstone is about 33 inches. The soil material is neutral to strongly alkaline. It is noncalcareous to a depth of about 12 inches and calcareous below this depth.

Cueva soils are used for range, as wildlife habitat, and for water supply. Pinyon and juniper trees are used for firewood and fenceposts.

Representative profile of Cueva very stony clay, 20 to 60 percent slopes, 1 mile northeast of Canoncito, ¼ mile north of U.S. Highway Nos. 84 and 85, SE¼ sec. 31, T. 16 N., R. 11 E.:

A1—0 to 3 inches, dusky-red (2.5YR 3/2), when dry or moist, very stony light clay; strong, fine and medium, granular structure; hard, friable when moist, sticky and plastic when wet; many fine roots; few fine tubular pores; 10 percent cobbles, 10 percent gravel, and 20 percent stones; noncalcareous; mildly alkaline (pH 7.6); clear boundary. 2 to 6 inches thick.

B2t—3 to 12 inches, dusky-red (2.5YR 3/2), when dry or

moist, clay; strong, fine and medium, angular blocky structure; extremely hard, firm when moist, very sticky and very plastic when wet; many fine and medium roots; very few fine tubular pores; smooth and shiny surfaces on pedis, presumably clay films; noncalcareous; neutral (pH 7.2); clear boundary. 8 to 15 inches thick.

B2t—12 to 19 inches, dusky red (2.5YR 3/2), when dry or moist, clay; moderate, medium, angular blocky structure; extremely hard, very firm when moist, very sticky and very plastic when wet; common medium roots; few very fine tubular pores; smooth and shiny surfaces on pedis, presumably clay films; strongly calcareous; moderately alkaline (pH 8.0); gradual boundary. 5 to 15 inches thick.

C1ca—19 to 27 inches, weak-red (2.5YR 5/2) silty clay loam, dusky red (2.5YR 3/2) when moist; massive; very hard, firm when moist, sticky and plastic when wet; common medium and coarse roots; few very fine tubular pores; few shale fragments that have coats of lime; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 2 to 12 inches thick.

C2ca—27 to 33 inches, pinkish-gray (5YR 6/2) gravelly silty clay loam, dark reddish-gray (5YR 4/2) when moist; massive; very hard, firm when moist, sticky and plastic when wet; 10 percent gravel and 10 percent cobbles; few very fine tubular pores; no roots; strongly calcareous; strongly alkaline (pH 8.6); abrupt boundary. 3 to 10 inches thick.

C3—33 inches, weakly weathered calcareous sandstone and shale that is lime coated in the upper part and in the fractures.

In the A and B horizons hue ranges from 5YR to 2.5YR. Value ranges from 3 to 5 when dry and is 2 or 3 when moist. Chroma is 2 or 3. The B2t horizon ranges from heavy clay loam and heavy silty clay loam to clay and silty clay. The A horizon and the upper part of the B horizon range from noncalcareous to calcareous. In the C horizon color varies, depending on the color of the underlying rock. Gravel, cobbles, and stones cover 15 to 30 percent of the surface. Depth to sandstone or shale bedrock is 20 to 48 inches.

**Cueva very stony clay, 20 to 60 percent slopes (CU).**—This soil is hilly to very steep. It is in the northeastern part of the survey area. Included in mapping were areas of Moriarty, Wilcoxson variant, and Encierro soils and sandstone and limestone rock land.

Permeability is very slow in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 20 to 48 inches. Available water holding capacity is 3 to 6 inches.

This soil is used for range, as wildlife habitat, and for water supply. Where this soil has stands of pinyon and juniper, it is a source of firewood and fenceposts. Dryland capability subclass VIIe; Mountain Shale range site; wildlife habitat group F.

## Cundiyo Series

The Cundiyo series consists of well-drained soils that formed in material derived from granite, gneiss, and schist. Slopes are 45 to 80 percent. The vegetation is mostly conifers and a scattered understory of forbs and mid grasses. Elevation ranges from 9,200 to 9,800 feet. The mean annual precipitation is 26 to 30 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 50 to 80 days. Associated soils are in the Mirabal, Supervisor, Bobtail, and Nambe series.

In a representative profile the surface layer is pale-brown gravelly sandy loam and very cobbly sandy loam about 14 inches thick. The subsoil is very pale brown and

light yellowish-brown very cobbly loam about 32 inches thick. The substratum is light yellowish-brown very cobbly loamy sand to a depth of 60 inches or more. The soil material is slightly acid or neutral.

Cundiyo soils are used for timber, as wildlife habitat, for water supply, and for recreation.

Representative profile of Cundiyo gravelly sandy loam, about 1 mile southwest of the Santa Fe Ski Basin, SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 18, T. 18 N., R. 11 E.:

- O—1 inch to 0, needles, leaves, and twigs in various stages of decomposition. 1 to 2 inches thick.
- A21—0 to 6 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, very fine and fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and few medium roots; common very fine interstitial pores; neutral (pH 6.8); clear, smooth boundary. 4 to 10 inches thick.
- A22—6 to 14 inches, pale-brown (10YR 6/3) very cobbly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; soft and very friable when moist, nonsticky and nonplastic when wet; many very fine and few medium roots; many very fine interstitial pores; slightly acid (pH 6.2); gradual, smooth boundary. 6 to 12 inches thick.
- B21t—14 to 34 inches, very pale brown (10YR 7/3) very cobbly loam, dark brown (10YR 4/3) when moist; weak, very fine, granular structure; slightly hard when moist, nonsticky and nonplastic when wet; common very fine and fine roots; many very fine and fine tubular pores; slightly acid (pH 6.4); gradual, smooth boundary. 15 to 30 inches thick.
- B22t—34 to 46 inches, light yellowish-brown (10YR 6/4) very cobbly loam, yellowish brown (10YR 5/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, slightly plastic and nonsticky when wet; few very fine and fine roots; few thin clay films on coarse fragments and between sand grains; common very fine and fine tubular pores; slightly acid (pH 6.4); gradual, smooth boundary. 10 to 20 inches thick.
- C—46 to 60 inches, light yellowish-brown (10YR 6/4) very cobbly loamy sand, yellowish brown (10YR 5/4) when moist; massive; friable, nonsticky and nonplastic; very few very fine and fine roots; common very fine and fine interstitial pores; slightly acid (pH 6.4).

In the A horizon hue is 10YR, and value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. Texture is light loam or sandy loam, and structure is moderate to weak granular and weak subangular blocky structure. In the B2t horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 3 or 4. This horizon is loam or sandy loam that has 3 percent or more clay than the A horizon. Sand is estimated to be in excess of 50 percent, and clay is estimated to range from 5 to 14 percent. In the C horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 4 or 5. The C horizon has very weak structure or is massive. The soil material is 20 to 50 percent coarse fragments to a depth of 10 inches and 50 to 90 percent coarse fragments below that depth.

**Cundiyo gravelly sandy loam, 45 to 80 percent slopes (CV).**—This soil is steep to very steep. It is in the northeastern part of the survey area. Included in mapping were areas of Supervisor soils and areas where rocks crop out.

Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 60 inches or more. Available water holding capacity is 4.5 to 5.5 inches.

This soil is used as timberland, as wildlife habitat, for water supply, and for recreation. Dryland capability subclass VIIe; timber suitability groups 2, 5, and 8; wildlife habitat group G.

## Dean Series

The Dean series consists of well-drained loamy soils on ridges and hills. These soils formed in mixed alluvium. Depth to soft caliche is 6 to 16 inches. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses and scattered pinyon and juniper trees. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Pastura, Harvey, Clovis, Tapia, and Witt series.

In a representative profile the surface layer is brown loam about 4 inches thick. The next layer is light-brown loam about 5 inches thick. The substratum, to a depth of 60 inches or more, is pink and pale-brown soft caliche that is very gravelly loam in texture and has a very high content of lime. The soil material is calcareous and moderately alkaline to strongly alkaline.

Dean soils are used for range, as wildlife habitat, and for water supply.

The Dean soils are mapped only in complexes with the Pastura, Harvey, and Tapia soils.

Representative profile of Dean loam in an area of Dean-Pastura loams, 1 to 9 percent slopes,  $\frac{1}{2}$  mile north of the Torrance County line, in the center of sec. 32, T. 10 N., R. 10 E.:

- A1—0 to 4 inches, brown (7.5YR 5/4) loam, brown (7.5YR 4/4) when moist; weak, thick, platy structure and weak, fine, granular; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 3 to 6 inches thick.
- AC—4 to 9 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and nonplastic when wet; common fine and very fine roots; common fine tubular pores; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 4 to 8 inches thick.
- C1ca—9 to 19 inches, pink (7.5YR 8/4) soft caliche of very gravelly loam, light brown (7.5YR 6/4) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, nonsticky and nonplastic when wet; very few fine roots; very few fine tubular pores; 50 to 75 percent pebbles and caliche fragments coated with calcium carbonate; strongly calcareous; strongly alkaline (pH 8.8); abrupt boundary. 8 to 16 inches thick.
- C2ca—19 to 60 inches, very pale brown (10YR 8/3) soft caliche of very gravelly loam, brown (10YR 5/3) when moist; massive; very hard, firm when moist, nonsticky and nonplastic when wet; no roots; 50 to 60 percent pebbles coated with calcium carbonate; common soft and hard concretions, disseminations of lime between concretions; content of lime decreases below a depth of 36 inches; strongly calcareous; strongly alkaline (pH 8.8).

In the A horizon value ranges from 5 to 7 when dry but is 4 or 5 when moist. Chroma ranges from 2 to 4. In the AC horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. The AC horizon ranges from loam to light clay loam. Depth to the Cca horizon is 6 to 16 inches. The content of calcium carbonate is more than 40 percent in the upper part of the Cca horizon. Below a depth of 36 to 40 inches the content of calcium carbonate decreases markedly with depth.

**Dean-Pastura loams, 1 to 9 percent slopes (DP).**—This complex consists of about 70 percent Dean loam and 20 percent Pastura loam. These soils are nearly level to moderately sloping and are intermingled in a definite or repeat-

ing pattern. Included soils make up the other 10 percent. These are soils of the Harvey and Tapia series. This complex is in the southern part of the survey area.

The Dean soil is on ridges and side slopes. Permeability is low. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 6 to 16 inches. Available water holding capacity is 1.5 to 3 inches.

The Pastura soil is on ridge crests. Permeability is moderate. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 8 to 20 inches. Available water holding capacity is 1.5 to 3 inches.

The soils in this complex are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VII<sub>s</sub>; Shallow range site; wildlife habitat group A.

## El Rancho Series

The El Rancho series consists of well-drained soils that formed in mixed alluvium from the Santa Fe formation and granitic material on terraces. Slopes are 0 to 5 percent. In areas where these soils are not cultivated, the vegetation is mostly mid grasses. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Along the Rio Arriba County line, in the northern part of the survey area, the soils are mostly at lower elevation and are warmer and drier. Associated soils are in the Fruitland, Ancho, and Bluewing series.

In a representative profile the surface layer is light reddish-brown sandy clay loam about 10 inches thick. The substratum, to a depth of 60 inches or more, is light reddish-brown and light-brown sandy clay loam. The soil material is calcareous and moderately alkaline.

El Rancho soils are used for irrigated crops, for range, as wildlife habitat, and for water supply.

Representative profile of El Rancho sandy clay loam, 1 to 3 percent slopes, 1 mile northeast of Pojoaque, NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 5, T. 19 N., R. 9 E.:

A1—0 to 10 inches, light reddish-brown (5YR 6/3) sandy clay loam, reddish brown (5YR 4/3) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; many fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 8 to 12 inches thick.

C1—10 to 18 inches, light reddish-brown (5YR 6/3) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine and medium roots; few medium tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 14 inches thick.

C2—18 to 60 inches, light-brown (7.5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few medium roots to a depth of 40 inches; few medium tubular pores; slightly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. In the C horizon value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. It ranges from loam to sandy clay loam. The soil is generally calcareous throughout, but small areas are free of lime to a depth of a few inches.

**El Rancho sandy clay loam, 0 to 1 percent slopes** (Ec).—This soil is level. It is in the northern part of the survey area. Included in mapping were small areas of

Ancho clay loam and minor areas of El Rancho sandy clay loam, 1 to 3 percent slopes.

Permeability is moderate in this soil. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 8 to 9.5 inches.

This soil is used for irrigated crops, for range, as wildlife habitat, and for water supply. Irrigated capability unit I-1; Loamy range site; wildlife habitat group I.

**El Rancho sandy clay loam, 1 to 3 percent slopes** (Ed).—This nearly level soil is in the northern part of the survey area. It has the profile described as representative for the series.

Included with this soil in mapping were areas of Ancho and Fruitland soils. Also included were very small areas where the water table is high and the soil is slightly saline.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 8 to 9.5 inches.

This soil is used for irrigated crops, for range, as wildlife habitat, and for water supply. The crops most commonly grown under irrigation are orchard products and alfalfa. Irrigated capability unit IIe-1; Loamy range site; wildlife habitat group I.

**El Rancho sandy clay loam, 3 to 5 percent slopes** (Ee).—This soil is gently sloping. It is in the northern part of the survey area. In places, mostly in the Tesuque Valley, the surface layer is gravelly.

Included with this soil in mapping were areas of Gullied land. Where it has been possible to divert the water, the soils have been benched and leveled and are irrigated. Also included were small areas of Ancho clay loam and Fruitland sandy loam, 3 to 5 percent slopes, and small areas where slope is as much as 25 percent.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate to severe. Effective rooting depth is about 60 inches. Available water holding capacity is 8 to 9.5 inches.

This soil is used for irrigated crops, for range, as wildlife habitat, and for water supply. Irrigated capability unit IIIe-2; Loamy range site; wildlife habitat group I.

**El Rancho-Fruitland complex** (El).—This complex consists of about 65 percent El Rancho loam and 25 percent Fruitland sandy loam. These soils are intermingled in a definite or repeating pattern. Slopes are 3 to 5 percent. Included in mapping, and making up about 10 percent of the mapped areas, are small areas of the Pojoaque-Rough broken land complex.

The El Rancho soil has a profile similar to that described as representative for the El Rancho series, except that the surface layer is loam. Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 60 inches or more. Available water holding capacity is 8 to 9.5 inches.

The Fruitland soil has a profile similar to that described as representative for the Fruitland series, except that the surface layer is sandy loam. Permeability is moderately rapid in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 6.5 to 7.5 inches.

The soils in this complex are used for range, as wildlife habitat, and for water supply. Dryland capability

subclass VIe; El Rancho soil in Loamy range site, Fruitland soil in Sandy range site; both soils in wildlife habitat group A.

### El Rancho Series, Sandy Subsoil Variant

The El Rancho series, sandy subsoil variant, consists of well-drained soils that formed in mixed alluvium from the Santa Fe formation and granitic material on terraces. Slopes are 0 to 3 percent. Unless these soils are irrigated, the vegetation is mostly mid grasses. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Fruitland, Ancho, and Bluewing series.

In a representative profile the surface layer is light reddish-brown sandy clay loam about 10 inches thick. The substratum, to a depth of about 22 inches, is light reddish-brown sandy clay loam. Below this the substratum is pinkish-gray very gravelly fine sand to a depth of 60 inches or more. The soil material is calcareous and moderately alkaline.

Soils of this series are used for irrigated crops, for range, as wildlife habitat, and for water supply.

Representative profile of El Rancho sandy clay loam, sandy subsoil variant, 3 miles west of Pojoaque, NE $\frac{1}{4}$  SE $\frac{1}{4}$  sec. 11, T. 19 N., R. 8 E.:

A1—0 to 10 inches, light reddish-brown (5YR 6/3) sandy clay loam, reddish brown (5YR 4/3) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; many fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 8 to 12 inches thick.

C1—10 to 22 inches, light reddish-brown (5YR 6/3) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine and medium roots; few medium tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 12 to 16 inches thick.

IIC2—22 to 60 inches, pinkish-gray (7.5YR 6/2) very gravelly fine sand, dark brown (7.5YR 4/2) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; about 75 percent igneous gravel; common fine interstitial pores; no roots; slightly calcareous; moderately alkaline (pH 8.0).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. In the C horizon value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. The C1 horizon ranges from sandy clay loam to loam. The soil is generally calcareous throughout, but small areas are free of lime to a depth of a few inches.

**El Rancho sandy clay loam, sandy subsoil variant** (0 to 3 percent slopes) (Eh).—This soil is level to nearly level. It is in the northern part of the survey area.

Included with this soil in mapping were small areas of soils that have a coarse-textured surface layer. Also included was a minor acreage of El Rancho sandy clay loam, 1 to 3 percent slopes.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 36 inches. Available water holding capacity is 4 to 5 inches.

This soil is used for irrigated crops, for range, as wildlife habitat, and for water supply. Irrigated capability unit IIIe-3; Loamy range site; wildlife habitat group J.

### Encierro Series

The Encierro series consists of well-drained soils on tops of mesas and sides of ridges. Depth to sandstone and interbedded shale is 8 to 20 inches. Slopes are 0 to 20 percent. The vegetation is mostly ponderosa pine, pinyon and juniper, shrubs, and mid grasses. Elevation ranges from 7,000 to 8,000 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 120 to 130 days. Associated soils are in the Cueva, Ortiz, Laporte, Hagerman, and Rednun series.

In a representative profile the surface layer is brown stony fine sandy loam and reddish-brown sandy loam about 9 inches thick. The subsoil is reddish-brown sandy clay about 7 inches thick. It is underlain by sandstone bedrock at a depth of about 16 inches. The soil material is noncalcareous, and reaction is neutral or slightly acid.

Encierro soils are used as timberland, as wildlife habitat, for water supply, and, to a limited extent, for range.

Representative profile of Encierro stony fine sandy loam, 0 to 20 percent slopes, 2 miles south and 1 mile east of Glorietta, 1 mile south of U.S. Highway Nos. 84 and 85, SW $\frac{1}{4}$  sec. 2, T. 15 N., R. 11 E.:

A1—0 to 5 inches, brown (7.5YR 5/2) stony fine sandy loam, dark brown (7.5YR 3/2) when moist; mostly weak, fine and medium, granular structure, upper 2 inches are platy; soft, friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; 15 to 35 percent stones; noncalcareous; neutral (pH 6.6); clear boundary. 3 to 6 inches thick.

A3—5 to 9 inches, reddish-brown (5YR 5/3) sandy loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; noncalcareous; slightly acid (pH 6.4); clear boundary. 0 to 4 inches thick.

B2t—9 to 16 inches, reddish-brown (5YR 4/3) sandy clay, dark reddish brown (5YR 3/3) when moist; moderate, medium and coarse, angular blocky structure; extremely hard, very firm when moist, sticky and plastic when wet; few medium roots; few medium and fine tubular pores; medium continuous clay films; noncalcareous; slightly acid (pH 6.4); clear boundary. 5 to 10 inches thick.

R—16 inches, light-colored sandstone that has a few fractures.

In the A1 horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the A3 horizon hue ranges from 7.5YR to 5YR, and value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 5YR or 2.5YR, and value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. The B2t horizon ranges from heavy clay loam to sandy clay. Depth to bedrock is 8 to 20 inches.

**Encierro stony fine sandy loam, 0 to 20 percent slopes** (EN).—This soil is nearly level to moderately steep. It is in the northeastern part of the survey area. Included in mapping were areas of Hagerman, Ortiz, and Laporte soils and small areas where rocks crop out.

Permeability is slow in this soil. Runoff is slow to rapid, and the hazard of erosion is moderate. Effective rooting depth is 8 to 20 inches. Available water holding capacity is 1 to 2.5 inches.

This soil is used as timberland, as wildlife habitat, and for water supply. Where this soil has stands of pinyon and juniper, it is a source of firewood and fenceposts. Dryland capability subclass VIIe; timber suitability group 3; wildlife habitat group F.

## Fivemile Series

The Fivemile series consists of well-drained soils on flood plains. They formed in mixed recent alluvium. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in Bluewing, Panky, and Pojoaque series.

In a representative profile the surface layer is brown loam about 5 inches thick. The next layer is light-brown loam about 12 inches thick. The substratum is brown silt loam to a depth of 60 inches or more. The soil material is calcareous (fig. 6) and moderately alkaline.

Fivemile soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Fivemile loam, 4 miles southwest of Santa Fe, 1½ miles east of the junction of State Route No. 10 and U.S. Highway No. 85, NE¼ sec. 30, T. 16 N., R. 9 E.:

- A1—0 to 5 inches, brown (10YR 5/3) loam, dark brown (10 YR 3/3) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and slightly plastic when wet; few fine and medium roots; few fine tubular pores; slightly calcareous; moderately alkaline (pH 7.9); clear boundary. 3 to 6 inches thick.
- AC—5 to 17 inches, light-brown (7.5YR 6/3) loam, dark brown (7.5YR 4/3) when moist; weak, coarse, prismatic structure and weak, medium, subangular blocky; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; very few medium roots; common fine tubular pores; many insect casts; strongly calcareous; moderately alkaline (pH 8.0); clear boundary. 10 to 15 inches thick.
- C—17 to 60 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure and weak, medium, subangular blocky; hard, very friable when moist, slightly sticky and slightly plastic when wet; very few medium roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.0).

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. In the AC horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 3 or 4. The AC horizon ranges from very fine sandy loam to loam. In the C horizon hue is 7.5YR or 10YR, and value is 5 or 6 when dry. Chroma is 3 or 4. Strata of coarser and finer textured materials 1 to 2 inches thick are common below a depth of 20 inches.

**Fivemile loam** (0 to 5 percent slopes) (Fe) (FF).—This soil is level to gently sloping. It is scattered throughout the northern half of the survey area. It is mapped at both high and low intensity but is mostly in the low-intensity area. Included in mapping were areas of Bluewing and La Brier soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 11 to 12 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group C.

## Fortwingate Series, Loamy Subsoil Variant

The Fortwingate series, loamy subsoil variant, consists of well-drained soils on mountains. These soils formed in material weathered from sandstone and shale. Depth to

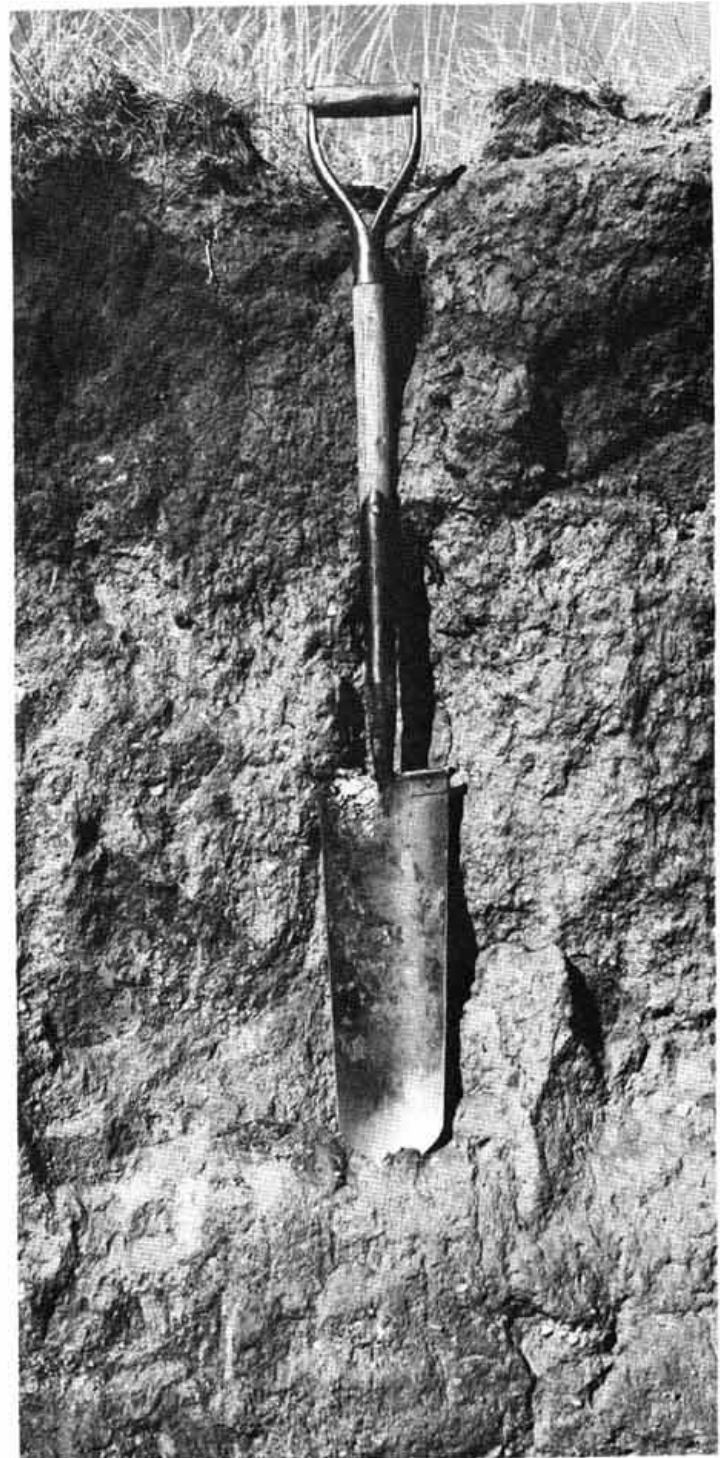


Figure 6.—Profile of Fivemile loam.

bedrock is 40 to 55 inches. Slopes are 30 to 60 percent. The vegetation is mostly mixed conifers, forbs, and mid grasses. Elevation ranges from 8,200 to 9,400 feet. The mean annual precipitation is 24 to 26 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 70 to 100 days. Associated soils are in the Wilcoxson variant, McVickers variant, Cundiyo, and Supervisor series.



In a representative profile the surface layer is dark grayish-brown gravelly sandy loam about 3 inches thick. The subsurface layer is light-gray gravelly sandy loam about 10 inches thick. The next layer is very pale brown cobbly sandy clay loam about 20 inches thick. The subsoil is reddish-brown cobbly sandy clay loam about 17 inches thick. Partly weathered sandstone and shale are at a depth of about 50 inches. The soil material is noncalcareous and neutral to slightly acid.

Soils of this series are used for timber, as wildlife habitat, and for water supply.

Representative profile of Fortwingate gravelly sandy loam, loamy subsoil variant, 30 to 60 percent slopes, about 7 miles north of La Cueva, SE $\frac{1}{4}$  sec. 14, T. 17 N., R. 11 E.:

O1—3 inches to 1 inch, fresh and partly decomposed needles, twigs, cones, and other organic material.

O2—1 inch to 0, decomposed and decomposing organic material similar in origin to material in O1 horizon.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many medium and fine roots; common fine and medium interstitial pores; 15 percent gravel; noncalcareous; neutral (pH 6.8); clear boundary. 2 to 4 inches thick.

A2—3 to 13 inches, light-gray (10YR 7/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular structure; soft, friable when moist, nonsticky and nonplastic when wet; many medium and few coarse roots; common medium tubular pores; 15 percent gravel and 5 percent cobblestones; noncalcareous; neutral (pH 6.8); clear boundary. 8 to 12 inches thick.

A&B—13 to 33 inches, very pale brown (10YR 7/3) cobbly sandy clay loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common medium roots; common fine and medium tubular pores; few moderately thick clay films; 20 percent cobblestones and 15 percent gravel; noncalcareous; neutral (pH 6.6); clear boundary. 15 to 25 inches thick.

B2t—33 to 41 inches, reddish-brown (5YR 4/4) cobbly sandy clay loam, dark reddish brown (5YR 3/4) when moist; very pale brown (10YR 7/4) coatings on ped faces; moderate, medium, subangular and angular blocky structure; very hard, firm when moist, sticky and plastic when wet; very few medium roots; common fine tubular pores; common moderately thick clay films; 25 percent cobblestones and 10 percent gravel; noncalcareous; neutral (pH 6.6); clear boundary. 6 to 12 inches thick.

B3—41 to 50 inches, reddish-brown (5YR 4/4) cobbly sandy clay loam, dark reddish brown (5YR 3/4) when moist; very pale brown (10YR 7/4) coatings on ped faces; very weak, medium, subangular blocky structure; very hard, very firm when moist, sticky and plastic when wet; very few fine roots; few fine tubular pores; 30 percent cobblestones and 20 percent gravel; noncalcareous; slightly acid (pH 6.4); clear boundary. 7 to 11 inches thick.

R—50 inches, partly weathered sandstone and shale.

In the A1 horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the A2 horizon hue ranges from 10YR to 7.5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 2 or 3. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B2t horizon ranges from cobbly loam or cobbly sandy clay loam to cobbly clay loam. Gravel, cobblestones, and stones cover 15 to 50 percent of the surface. Content of gravel and cobblestones ranges from 20 to 35 percent between depths of 10 to 40 inches, and 35 to 60 percent below. Depth to bedrock is 40 to 55 inches.

**Fortwingate gravelly sandy loam, loamy subsoil**

**variant, 30 to 60 percent slopes (FG).**—This soil is steep to very steep. It is in the northeastern part of the survey area. Included in mapping were areas of Wilcoxson variant, McVickers variant, and Cundiyo soils and small areas where rock crops out.

Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 40 to 55 inches. Available water holding capacity is 4.5 to 5.5 inches.

This soil is used as timberland, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; timber suitability groups 1, 4, and 8; wildlife habitat group G.

## Fruitland Series

The Fruitland series consists of well-drained soils that formed in mixed alluvium from the Santa Fe formation and granitic material on alluvial fans. Slopes are 0 to 5 percent. Where these soils are not irrigated, the vegetation is mostly mid grasses. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Pojoaque and El Rancho series.

In a representative profile the surface layer is brown sandy clay loam about 3 inches thick. The substratum to a depth of about 13 inches is brown sandy clay loam. Below this, it is light-brown fine sandy loam to a depth of 60 inches or more. The soil material is calcareous and moderately alkaline.

Fruitland soils are used for irrigated crops, for range, as wildlife habitat, and for water supply.

Representative profile of Fruitland sandy clay loam, 0 to 3 percent slopes, 1½ miles northeast of the San Ildefonso Pueblo, NW¼ sec. 10, T. 19 N., R. 8 E.:

A1—0 to 3 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; slightly calcareous, moderately alkaline (pH 8.0); clear boundary. 2 to 4 inches thick.

C1—3 to 13 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; slightly calcareous, moderately alkaline (pH 8.2); clear boundary. 8 to 12 inches thick.

C2—13 to 60 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine interstitial pores; slightly calcareous, moderately alkaline (pH 8.2).

In the A1 and C1 horizons value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the C2 horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 5 or 6 when moist. Chroma ranges from 2 to 4. The C2 horizon ranges from loamy very fine sand to fine sandy loam.

**Fruitland sandy loam, 0 to 3 percent slopes (Fn).**—This soil is level to nearly level. It is in the northern part of the survey area. Included in mapping were small areas of El Rancho sandy clay loam, 1 to 3 percent slopes, and Ancho clay loam.

Permeability is moderately rapid in this soil. Runoff is slow, and the hazard of erosion is moderate. Effective root-

ing depth is about 60 inches. Available water holding capacity is 6.5 to 7.5 inches.

This soil is used for irrigated crops, as wildlife habitat, and for water supply. Irrigated capability unit IIe-1; wildlife habitat group J.

**Fruitland sandy loam, 3 to 5 percent slopes (Fr).**—This soil is gently sloping. It is in the northern part of the survey area.

Included with this soil in mapping were areas of El Rancho and Ancho soils. Also included were small areas where slopes are as much as 9 percent.

Permeability is moderately rapid in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 6.5 to 7.5 inches.

This soil is used for irrigated crops, as wildlife habitat, and for water supply. The crops most commonly grown under irrigation are orchard products and alfalfa. Irrigated capability unit IIIe-2; wildlife habitat group J.

**Fruitland sandy loam, saline, 0 to 3 percent slopes (Fs).**—This level to nearly level soil is in the northern part of the survey area. It has a fluctuating water table. The depth to the water table ranges from 0 to 36 inches, depending on seasonal stream flow and local irrigation practices. Included in mapping were small areas of Bluewing loamy fine sand, saline, and El Rancho sandy clay loam, 1 to 3 percent slopes.

Permeability is moderately rapid in this soil. Runoff is slow, and the hazard of erosion is slight. Effective rooting depth is 30 to 40 inches. Available water holding capacity is 3.75 to 5 inches. Salt concentrations range from slight to moderate.

This soil is used for irrigated pasture, as wildlife habitat, and for water supply. Irrigated capability unit VIw-1; wildlife habitat group J.

**Fruitland sandy clay loam, 0 to 3 percent slopes (Ft).**—This soil is level to nearly level. It is in the northern part of the survey area. This soil has the profile described as representative for the series.

Included with this soil in mapping were areas of El Rancho and Ancho soils. Also included were small areas where slopes are as much as 9 percent.

Permeability is moderately rapid in this soil. Runoff is slow, and the hazard of erosion is slight. Effective rooting depth is about 60 inches. Available water holding capacity is 6.5 to 7.5 inches.

This soil is used for irrigated crops, as wildlife habitat, and for water supply. The crops most commonly grown under irrigation are orchard products and alfalfa. Irrigated capability unit IIs-1; wildlife habitat group J.

## Galisteo Series

The Galisteo series consists of well-drained soils on flood plains. These soils formed in alluvium derived from sandstone and shale. Slopes are 0 to 3 percent. The vegetation is mostly mid grasses and shrubs. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Prewitt, Travessilla, and Bernal series.

In a representative profile the surface layer is reddish-brown loam about 6 inches thick. The substratum is reddish-brown silty clay to a depth of about 25 inches. Below

this is a weak-red light silty clay to a depth of 60 inches or more. The soil material is calcareous and strongly alkaline.

Galisteo soils are used for range, for water supply, and as wildlife habitat.

Representative profile of Galisteo loam from an area of Galisteo-Gullied land complex, level, about 2 miles southwest of Lamy, SW $\frac{1}{4}$  sec. 9, T. 14 N., R. 10 E.:

A1—0 to 6 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine tubular pores; strongly calcareous; strongly alkaline (pH 8.5); abrupt boundary. 5 to 8 inches thick.

C1—6 to 25 inches, reddish-brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) when moist; weak, coarse, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few fine roots; few fine and medium tubular pores; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 15 to 25 inches thick.

C2—25 to 60 inches, weak red (2.5YR 4/2) light silty clay, dusky red (2.5YR 3/2) when moist; massive; very hard, friable, sticky and plastic when wet; very few fine roots; few fine tubular pores; strongly calcareous; strongly alkaline (pH 8.8).

In the A horizon value is 4 or 5 when dry and 3 or 4 when moist, Chroma ranges from 2 to 4. In the C horizon hue ranges from 2.5YR to 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. Between depths of 10 and 40 inches texture ranges from heavy silty clay loam to silty clay or clay.

**Galisteo-Gullied land complex, level (GG).**—This complex consists of about 70 percent Galisteo loam and 15 percent Gullied land. The Galisteo soils are level to nearly level. Gullied land consists of deep, vertically walled gullies as headcuts, and, in some areas, as a series of gullies that have only patches of Galisteo soils among them. Included in mapping, and making up 15 percent of the mapped areas, were Prewitt soils, Alluvial land, saline, and a small acreage of very dark soil that formed in alluvium derived from Mancos Shale around Waldo on the Galisteo Creek.

The Galisteo soil has the profile described as representative for the Galisteo series. Permeability is slow in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 60 inches or more. Available water holding capacity is 9 to 10 inches.

The soils in this complex are used for range for water supply, and as wildlife habitat. Dryland capability subclass VIIe; Salt Flats range site; wildlife habitat group E.

## Guaje Series

The Guaje series consists of well-drained soils that formed in pumice and other volcanic debris on foot slopes and hills. Depth to cemented pumice is 11 to 20 inches. Slopes are 10 to 30 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,400 to 7,000 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 140 to 150 days. Associated soils are in the Los-Alamos and Silver series.

In a representative profile the surface layer is a light brownish-gray gravelly sandy loam about 9 inches thick. The substratum, to a depth of about 14 inches, is pinkish-white very gravelly sandy loam. Below this, it is weakly



cemented white pumice. The soil material is mildly alkaline to moderately alkaline. It is noncalcareous to a depth of about 9 inches and calcareous below this depth.

Guaje soils are used as timberland and wildlife habitat and as a source of water. The pumice is used extensively for making building blocks.

Representative profile of Guaje gravelly sandy loam, 10 to 30 percent slopes,  $\frac{1}{2}$  mile south of the northwest corner of Santa Fe County, NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 31, T. 20 N., R. 7 E.:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; common fine and medium interstitial pores; about 20 percent fine pumice gravel; noncalcareous; mildly alkaline (pH 7.4); clear boundary. 1 to 3 inches thick.

A12—2 to 9 inches, light brownish-gray (10 YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; very weak, medium, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and few medium roots; many fine and medium interstitial pores; about 40 percent fine pumice gravel; noncalcareous; mildly alkaline (pH 7.6); clear boundary. 6 to 14 inches thick.

C1ca—9 to 14 inches, pinkish-white (7.5YR 8/2) very gravelly sandy loam, light brown (7.5YR 6/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine interstitial pores; about 55 percent pumice gravel; strongly calcareous; moderately alkaline (pH 8.0); abrupt boundary. 3 to 7 inches thick.

C2ca—14 to 60 inches, weakly cemented white pumice; cementation lessens with depth; strongly calcareous, powdery secondary lime decreases with depth; no roots.

In the A horizon value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the C1 horizon hue is 7.5YR or 10YR, and value is 7 or 8 when dry and ranges from 4 to 6 when moist. Chroma ranges from 2 to 4. The C1 horizon ranges from very gravelly sandy loam to gravelly loamy sand. Depth to cemented pumice ranges from 11 to 20 inches.

**Guaje gravelly sandy loam, 10 to 30 percent slopes (G1).**—This soil is strongly sloping to moderately steep. It is in the extreme northwestern part of the survey area.

Included with this soil in mapping were areas of Los Alamos and Silver soils. Also included were scattered areas of stony steep land and areas in canyon bottoms where the soils are moderately sloping, have darker surface layers, and are deeper to pumice.

Permeability is rapid in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is 11 to 20 inches. Available water holding capacity is 1 to 2 inches.

This soil is used as timberland and wildlife habitat and for water supply. The raw pumice is used extensively for making building blocks. Dryland capability subclass VIIe; timber suitability group 3; wildlife habitat group F.

## Hagerman Series

The Hagerman series consists of well-drained soils that formed in mixed wind-laid material over sandstone. These soils are on mesas. Depth to sandstone is 20 to 40 inches. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Rednun, Penistaja, Bernal, and Travessilla series.

In a representative profile the surface layer is brown fine sandy loam about 2 inches thick. The subsoil is brown and light-brown sandy clay loam about 21 inches thick. The substratum is light-brown sandy clay loam about 17 inches thick. Sandstone bedrock is at a depth of about 40 inches. The soil material is neutral to moderately alkaline in reaction. It is noncalcareous to a depth of 6 to 16 inches and calcareous below this depth.

Hagerman soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Hagerman fine sandy loam, 0 to 5 percent slopes, in the San Cristoval Grant, about 5 miles north of White Lakes, 150 yards northeast of windmill, NW $\frac{1}{4}$ NE $\frac{1}{4}$ , sec. 16, T. 12 N., R. 11 E.:

A1—0 to 2 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/2) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine and very fine interstitial pores; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 4 inches thick.

B2t—2 to 8 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/2) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine and very fine tubular pores; few, thin, patchy clay films; noncalcareous; mildly alkaline (pH 7.4); clear boundary. 4 to 12 inches thick.

B3ca—8 to 23 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few very fine tubular pores; lime mycelia on outer ped faces; slightly calcareous; mildly alkaline (pH 7.4); clear boundary. 10 to 18 inches thick.

C1ca—23 to 30 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); clear boundary. 6 to 10 inches thick.

C2ca—30 to 40 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; common very fine tubular pores; mycelia and soft masses of lime; slightly calcareous; moderately alkaline (pH 8.4); abrupt boundary. 5 to 10 inches thick.

R—40 inches. Glorieta sandstone that has a  $\frac{1}{2}$ -inch coating of calcium carbonate.

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR or 5YR. Value is 5 or 6 when dry, and it ranges from 3 to 5 when moist. Chroma ranges from 2 to 4. The B2t horizon ranges from light sandy clay loam to heavy sandy clay loam. In the Cca horizon hue is 7.5YR or 5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. Depth to bedrock ranges from 20 to 40 inches.

**Hagerman fine sandy loam, 0 to 5 percent slopes (HA).**—This soil is level to gently sloping. It is in the southern part of the survey area. Included in mapping were areas of Rednun, Penistaja, Bernal, and Travessilla soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 40 inches. Available water holding capacity is 4.5 to 6 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

## Harvey Series

The Harvey series consists of well-drained soils that formed in mixed old alluvium on piedmont uplands. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 13 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 170 days. Associated soils are in the Witt, La Brier, Dean, and Pastura series.

In a representative profile the surface layer is brown loam and light-brown sandy clay loam about 12 inches thick. The next layer is brown clay loam about 5 inches thick. The substratum to a depth of about 27 inches is pink clay loam that has a high content of lime (fig. 7). Below this the substratum, to a depth of 60 inches or more, is light reddish-brown sandy clay loam. The soil material is calcareous and moderately alkaline.

Harvey soils are used for range, as wildlife habitat, for water supply, and, to a very limited extent, for irrigated crops.

Representative profile of Harvey loam, 1 to 9 percent slopes, 1½ miles north and 1½ miles west of Edgewood, SW¼SW¼ sec. 14, T. 10 N., R. 7 E.:



Figure 7.—Profile of Harvey loam.

A11—0 to 3 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure and weak, fine, granular; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 4 inches thick.

A12—3 to 12 inches, light-brown (7.5YR 6/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure and weak, medium, subangular blocky; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 12 inches thick.

AC—12 to 17 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, coarse, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; few fine tubular pores; few soft lime nodules; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 3 to 8 inches thick.

C1ca—17 to 27 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable when moist, sticky and plastic when wet; very few fine roots; few fine and very fine tubular pores; more calcium carbonate than in horizon above or below, disseminated and as threads; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 8 to 12 inches thick.

C2—27 to 60 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; very few very fine pores; strongly calcareous; moderately alkaline (pH 8.4); clear boundary.

In the A horizon value is 3 or 4 when moist. Chroma ranges from 2 to 4. In the Cca horizon hue is 7.5YR or 5YR, and value is 6 or 7 when dry and 5 or 6 when moist. Chroma is 3 or 4. The Cca horizon ranges from loam to sandy clay loam or clay loam. In the C2 horizon hue is 7.5YR or 5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4. Strata of igneous gravel are common below a depth of 27 inches.

**Harvey loam, 1 to 9 percent slopes (HC).**—This soil is nearly level to moderately sloping. It is in all parts of the survey area but mostly in the southern half. This soil has the profile described as representative for the series.

Included with this soil in mapping were areas of Pojoaque, Dean, La Brier, Panky, and Witt soils. Also included, along the Rio Arriba County line to the north, were areas of soils that have a noncalcareous surface layer and subsoil.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 9 to 10 inches.

This soil is used mostly for range, as wildlife habitat, and for water supply. A very small acreage is in irrigated crops. Dryland capability subclass VIe; Loamy range site; wildlife habitat group C.

**Harvey-Dean loams, 1 to 9 percent slopes (HD).**—This complex consists of about 60 percent Harvey loam and 30 percent Dean loam. These soils are nearly level to moderately sloping. Included soils make up the other 10 percent. These are Pastura, Clovis, and Tapia soils.

Permeability is moderate in the Harvey soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 9 to 10 inches.

Permeability is slow in the Dean soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting

depth is 6 to 16 inches. Available water holding capacity is 1.5 to 3 inches.

The soils in this complex are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Harvey soil in Loamy range site, Dean soil in Shallow range site; both soils in wildlife habitat group A.

**Harvey-Penistaja sandy loams, 0 to 5 percent slopes (HP).**—This complex consists of about 45 percent Harvey sandy loam and 35 percent Penistaja sandy loam. These soils are nearly level to undulating. Included soils make up the other 20 percent. These are Otero and Palma fine sandy loams.

The Harvey soil has a profile similar to that described as representative for the Harvey series, except that the surface layer is sandy loam about 11 inches thick. Permeability is moderate in this soil. Runoff is slow, and the hazard of soil blowing is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 9 to 10 inches.

The Penistaja soil has a profile similar to that described as representative for the Penistaja series, except that the surface layer is sandy loam. Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 8.5 to 10 inches.

The soils in this complex are used mainly for range and as wildlife habitat. A few acres are in irrigated crops. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

**Harvey-Cerrillos association, undulating (HR).**—This association consists of about 40 percent Harvey fine sandy loam that has slopes of 5 to 9 percent and 30 percent Cerrillos fine sandy loam that has slopes of 1 to 5 percent. Included soils make up the other 30 percent. These are Panky, Pojoaque, Fivemile, and Bluewing soils.

The Harvey soil has a profile similar to that described as representative for the Harvey series, except that the substratum is clay loam and the content of lime is higher. Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth in this Harvey soil is about 60 inches. Available water holding capacity is 9 to 10 inches.

Permeability is moderate in the Cerrillos soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth in this soil is 10 to 20 inches. Available water holding capacity is 1.5 to 2.5 inches.

The soils in this association are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

## La Brier Series

The La Brier series consists of well-drained soils that formed in mixed alluvium on concave alluvial fans of drainageways. Slopes are 0 to 1 percent. The vegetation is mostly mid and short grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Witt and Harvey series.

In a representative profile the surface layer is brown loam about 2 inches thick. The subsoil is dark reddish-gray clay loam and heavy clay loam about 15 inches thick. The

substratum is dark reddish-gray clay loam to a depth of 60 inches or more. The soil material is noncalcareous to a depth of about 17 inches and calcareous below this depth. It is moderately alkaline throughout.

La Brier soils are used for range, irrigated crops, and water supply and as wildlife habitat.

Representative profile of La Brier loam, 1½ miles north and 4 miles west of Otto, NE¼NE¼ sec. 16, T. 10 N., R. 8 E.:

A1—0 to 2 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine vesicular pores; noncalcareous; moderately alkaline (pH 8.0); clear boundary. 2 to 4 inches thick.

B1—2 to 7 inches, dark reddish-gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) when moist; moderate, fine, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; common fine and very fine roots; few fine tubular pores; thin discontinuous clay films; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 8 inches thick.

B2t—7 to 17 inches, dark reddish-gray (5YR 4/2) heavy clay loam, dark reddish brown (5YR 3/2) when moist; moderate, coarse, angular and subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common very fine roots; very few fine tubular pores; thick continuous clay films on ped faces; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 8 to 15 inches thick.

Cca—17 to 60 inches, dark reddish-gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) when moist; massive; hard, firm when moist, sticky and plastic when wet; few very fine roots; few very fine tubular pores; disseminated calcium carbonate and a few filaments or threads; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 7.5YR or 5YR, and value is 3 or 4 when dry and 2 to 3 when moist. Chroma is 2 to 3. The B2t horizon ranges from heavy clay loam to light clay. In the Cca horizon hue is 7.5YR or 5YR, and value is 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. Strata of loamy sand below a depth of 30 inches are common. Soluble salts are below a depth of 40 inches where these soils are adjacent to old lake basins.

**La Briër loam (0 to 1 percent slopes) (LB).**—This soil is level. It is in the southern part of the survey area. Included in mapping were areas of Moriarty and Willard soils.

Permeability is slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 60 inches or more. Available water holding capacity is 10 to 12 inches. In places this soil receives runoff from adjacent soils.

This soil is in irrigated crops, and it is used for range and water supply and as wildlife habitat. Irrigated capability unit IIew-1; dryland capability subclass VIew; Bottomland range site; wildlife habitat group C.

## La Fonda Series

The La Fonda series consists of well-drained soils that formed in old alluvium and mixed wind-laid deposits on alluvial fans. Slopes are 3 to 10 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Santa Fe and Panky series.

In a representative profile the surface layer is brown heavy loam about 4 inches thick. The subsoil is brown sandy clay loam about 16 inches thick. The substratum to a depth of 34 inches is brown sandy clay loam that in places contains free lime. Below this, it is brown sandy clay loam and sandy loam to a depth of 60 inches or more. The soil is noncalcareous to a depth of 15 to 24 inches and calcareous below this depth. It is moderately alkaline to strongly alkaline.

La Fonda soils are used for range, as wildlife habitat, and for water supply and community development.

Representative profile of La Fonda loam in an area of Santa Fe-La Fonda association, hilly, 5 miles south of the city limits of San Fe, 1 mile west of U.S. Highway Nos. 84, 85, and 285, NE $\frac{1}{4}$  sec. 30, T. 16 N., R. 10 E.:

- A1—0 to 4 inches, brown (7.5YR 5/4) heavy loam, dark brown (7.5YR 4/2) when moist; weak, very fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; very few fine tubular pores; 2 percent gravel; noncalcareous; moderately alkaline (pH 8.0); clear boundary. 3 to 6 inches thick.
- B1—4 to 12 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, granular structure; hard, friable when moist, sticky and plastic when wet; very few very fine roots; very few medium and fine tubular pores; 2 percent gravel; noncalcareous; moderately alkaline (pH 8.0); clear boundary. 6 to 8 inches thick.
- B2—12 to 20 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; very few fine roots; very few very fine tubular pores; 2 percent gravel; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 6 to 8 inches thick.
- C1ca—20 to 34 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; very hard, firm when moist, sticky and plastic when wet; very few very fine roots; common fine tubular pores; common lime streaks and concretions; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 12 to 16 inches thick.
- C2—34 to 42 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, sticky and plastic when wet; very few very fine roots; few fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 10 inches thick.
- C3—42 to 60 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic when wet; no roots; common fine interstitial pores; slightly calcareous; strongly alkaline (pH 8.6).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the B horizon hue is 7.5YR to 5YR, and value is 5 or 6 when dry and ranges from 3 to 5 when moist. Chroma ranges from 4 to 6. The B horizon ranges from light sandy clay loam to heavy sandy clay loam. The lower part of the B horizon ranges from noncalcareous to moderately calcareous. In the Cca horizon hue ranges from 7.5YR to 5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 3 or 4.

**La Fonda loam, 3 to 10 percent slopes (1f).**—This gently sloping to strongly sloping soil is mapped only in the vicinity of the city of Santa Fe.

Included with this soil in mapping were small areas of gravelly and cobbly soils and very small areas where erosion has formed gullies.

Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 60 inches or more. Available water holding capacity is 7.5 to 9 inches.

This soil is used for community development, range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group C.

## Laporte Series

The Laporte series consists of well-drained soils that formed in material weathered from limestone. Depth to bedrock is 8 to 20 inches. Slopes are 5 to 25 percent. The vegetation is mostly mid grasses, forbs, shrubs, and trees. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Witt, Clovis, Encierro, and Harvey series.

In a representative profile the surface layer is dark grayish-brown cobbly loam about 7 inches thick. The next layer is brown cobbly sandy clay loam about 6 inches thick. The substratum is brown gravelly loam that has a high content of lime. Fractured limestone is at a depth of about 19 inches. The soil is calcareous and strongly alkaline throughout.

Laporte soils are used for range, as wildlife habitat, for water supply, and as a source or rock for roadbuilding material. The pinyon and juniper trees are used for firewood and fenceposts.

Representative profile of Laporte cobbly loam in an area of Laporte-Rock outcrop complex, 5 to 25 percent slopes; 1 mile south of Edgewood, near the east quarter corner of sec. 33, T. 10 N., R. 7 E.:

- A1—0 to 7 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; few fine and medium tubular pores; 15 percent cobblestones and stones; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 4 to 10 inches thick.
- AC—7 to 13 inches, brown (10YR 5/3) cobbly sandy clay loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; few very fine tubular pores; 15 percent cobblestones and stones; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 0 to 7 inches thick.
- Cca—13 to 19 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; few very fine tubular pores; 25 percent gravel; strongly calcareous; strongly alkaline (pH 8.6); abrupt boundary, 4 to 8 inches thick.
- R—19 inches, fractured limestone bedrock.

In the A horizon value is 4 or 5 when dry, and chroma is 2 or 3. In the AC horizon hue is 10YR or 7.5YR, and value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. The AC horizon ranges from sandy clay loam to clay loam. In the Cca horizon hue ranges from 10YR to 7.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 2 to 4. Depth to limestone bedrock ranges from 8 to 20 inches.

**Laporte-Rock outcrop complex, 5 to 25 percent slopes (1g) (1h).**—This complex consists of about 65 percent Laporte cobbly loam and 25 percent Rock outcrop. Included soils make up the other 10 percent. These are soils of the Clovis, Cueva, Encierro, Harvey, and Witt series in the low-intensity survey and soils of the Chimayo and Cueva series in the high-intensity survey. The Laporte soil is moderately sloping to moderately steep. The Rock

outcrop is intermingled with this soil. This complex is in the southern half of the survey area. The major acreage is in the low-intensity area.

Permeability is moderate in the Laporte soils. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth is 8 to 20 inches. Available water holding capacity is 1.5 to 3 inches.

This complex is used for range, as wildlife habitat, for water supply, and as a source of rock for roadbuilding materials. Dryland capability subclass VII<sub>s</sub>; Shallow range site; wildlife habitat group F.

## Las Lucas Series

The Las Lucas series consists of well-drained soils that formed in material weathered from Mancos shale and mixed wind-laid materials. Depth to shale is 40 to 60 inches. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. The associated soils are in the Galisteo and Penistaja series.

In a representative profile the surface layer is brown heavy loam about 5 inches thick. The subsoil is pale-brown and light yellowish-brown clay loam about 24 inches thick. The substratum is light yellowish-brown clay loam. Shale is at a depth of about 50 inches. The soil material is calcareous throughout and moderately alkaline to strongly alkaline.

Las Lucas soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Las Lucas loam, 1 to 9 percent slopes, 6 miles south and 1 mile east of Galisteo, 50 feet each of State Route No. 41, NE $\frac{1}{4}$  sec. 36, T. 13 N., R. 9 E.:

A1—0 to 5 inches, brown (10YR 5/3) heavy loam, brown (10YR 4/3) when moist; weak, fine, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine and medium tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 3 to 7 inches thick.

B1—5 to 10 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; common fine and medium roots; common fine and very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 8 inches thick.

B2—10 to 15 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; weak, medium and fine, subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; few very fine roots; few fine and very fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 4 to 8 inches thick.

B3ca—15 to 29 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky; slightly hard, very friable when moist, sticky and plastic when wet; very few very fine roots; common medium and fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 12 to 18 inches thick.

C1ca—29 to 50 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, very friable when moist, sticky and plastic when wet; very few very fine roots; few

fine and very fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); abrupt boundary. 15 to 25 inches thick.

C2—50 inches, shale.

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. In the B horizon hue is 10YR or 2.5Y, and value is 6 or 7 when dry. The B horizon ranges from clay loam to silty clay loam. Depth to shale ranges from 40 to 60 inches.

**Las Lucas loam, 1 to 9 percent slopes (II).**—This soil is nearly level to moderately sloping. It is in the south-central part of the survey area. Included in mapping were areas of Fivemile and Galisteo soils and Alluvial land, saline, and, in places, areas of shale outcropping.

Permeability is slow in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 7.5 to 10 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VI<sub>e</sub>; Clayey range site; wildlife habitat group C.

## Los Alamos Series

The Los Alamos series consists of well-drained soils that formed in material weathered from pumice and other volcanic debris on uplands. Depth to pumice is 20 to 50 inches. Slopes are 0 to 10 percent. The vegetation is mostly mid grasses, annuals, and trees. Elevation ranges from 6,500 to 7,000 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 140 to 150 days. Associated soils are in the Guaje and Silver series.

In a representative profile the surface layer is light-brown sandy loam about 5 inches thick. The subsoil is brown clay loam and light-brown loam about 20 inches thick. The substratum, to a depth of about 40 inches, is very pale brown gravelly sandy loam. Below this, it is white, weakly cemented pumice and ash to a depth of 60 inches or more. The soil material is noncalcareous to a depth of 11 to 17 inches. It is mildly alkaline to strongly alkaline.

Los Alamos soils are used for range, as wildlife habitat, and for water supply. The pumice is used in making building blocks.

Representative profile of Los Alamos sandy loam in an area of Los Alamos-Silver sandy loams, 0 to 10 percent slopes, about  $\frac{1}{2}$  mile southwest of the northwest corner of Santa Fe County, NW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 31, T. 20 N., R. 7 E.:

A1—0 to 5 inches, light-brown (7.5YR 6/4) sandy loam; brown (7.5YR 4/2) when moist; weak, thin, platy structure in upper 1 inch and weak, fine, granular below; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common fine and medium interstitial pores; noncalcareous; mildly alkaline (pH 7.6); abrupt boundary. 2 to 8 inches thick.

B2t—5 to 14 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate and strong, fine and medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common fine and very fine roots; common very fine and fine tubular pores; common, thin, patchy clay films; noncalcareous; mildly alkaline (pH 7.8); abrupt boundary. 6 to 14 inches thick.

B3ca—14 to 25 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/2) when moist; weak, fine, subangular



blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; fine and very fine roots; many very fine and fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 12 inches thick.

C1ca—25 to 40 inches, very pale brown (10YR 7/3) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable when moist, non-sticky and nonplastic when wet; few fine roots; many very fine and fine interstitial pores; about 20 percent pumice gravel; strongly calcareous; strongly alkaline (pH 8.6); abrupt boundary. 8 to 16 inches thick.

C2ca—40 to 60 inches, white (10YR 8/2) mixture of pumice and ash, dark grayish brown (10YR 4/2) when moist; weakly cemented; strongly calcareous; strongly alkaline (pH 8.6).

In the A horizon value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR to 10YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 2 or 3. The B2t horizon ranges from sandy clay loam to clay loam. In the B3ca horizon hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the Cca horizon hue is 7.5YR to 10YR, and value ranges from 4 to 6 when moist. Chroma ranges from 2 to 4. Depth to pumice ranges from 20 to 50 inches.

**Los Alamos-Silver sandy loams, 0 to 10 percent slopes (LS).**—This complex consists of about 55 percent Los Alamos sandy loam and 35 percent Silver sandy loam. Included soils make up the other 10 percent. These are Guaje soils and a few acres of soils that formed in alluvium. The soils in this complex are level to strongly sloping. This complex is only in the extreme northwestern part of the survey area.

Permeability is moderate in the Los Alamos soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 50 inches to pumice and ash. Available water holding capacity is 4 to 6 inches.

The Silver soil has a profile similar to that described as representative for the Silver series, except that the surface layer is sandy loam. Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 10.5 to 11.5 inches.

This complex is used for range, as wildlife habitat, and for water supply. The pumice in the Los Alamos soils is used in making building blocks. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

## Lunch Series, Shallow Variant

The Lunch series, shallow variant, consists of poorly drained soils that formed in mixed alluvium derived mostly from granite, gneiss, and schist. These soils are in mountain basins and valleys. Slopes are 0 to 5 percent. The vegetation is mostly water-tolerant grasses and sedges and spruce and fir around bogs. Elevation ranges from 10,500 to 12,000 feet. The mean annual precipitation is 35 to 45 inches, and the mean annual air temperature is 38° to 42° F. The frost-free season is 30 to 50 days. Associated soils are in the Nambe and Adel series.

In a representative profile about 5 inches of peat is on the surface. Below this the surface mineral layer is dark grayish-brown silt loam about 5 inches thick. The next layer is silt loam about 5 inches thick. It is variegated, ranging from very dark gray to light yellowish brown. The substratum, to a depth of 60 inches or more, is light

olive-gray silt loam that has many large, prominent mottles. The soil material is medium acid throughout.

Lunch soils are used for water supply and as wildlife habitat and timberland.

Representative profile of Lunch peat, shallow variant, about 1 mile east of Santa Fe Basin Ski Lodge, NE $\frac{1}{4}$  NW $\frac{1}{4}$  sec. 16, T. 18 N., R. 11 E.:

O1—5 inches to 0, a fibrous sedge-peat layer, mostly of grasses, reeds, and water-tolerant plants; abrupt boundary. 3 to 10 inches thick.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure and moderate, fine, crumb; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and common medium roots; common fine tubular pores; medium acid (pH 6.0); abrupt boundary. 4 to 10 inches thick.

AC—5 to 10 inches, variegated silt loam, ranging from very dark gray (10YR 3/1) to light yellowish brown (2.5Y 6/3), black (10YR 2/1), to olive brown (2.5Y 4/3) when moist; weak, medium, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and medium roots; common fine tubular pores; thin strata of somewhat coarser textured material; medium acid (pH 6.0); smooth boundary. 4 to 8 inches thick.

Cg—10 to 60 inches, light olive-gray (5Y 6/2) silt loam, olive gray (5Y 5/2) when moist; many large, prominent, light olive-brown (2.5Y 5/4) mottles; massive; hard; very friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; few fine tubular pores; medium acid (pH 6.0).

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma ranges from 1 to 3. In the AC horizon hue ranges from 10YR to 5Y, and value ranges from 3 to 6 when dry and 2 to 5 when moist. Chroma ranges from 1 to 3. In the Cg horizon hue ranges from 2.5Y to 5Y, and value ranges from 4 to 6 when dry and 3 to 5 when moist. Chroma ranges from 2 to 4. The Cg horizon ranges from silt loam and light silty clay loam to loam or light clay loam. Cobblestones and stones are common below a depth of 30 inches.

**Lunch peat, shallow variant (0 to 5 percent slopes) (LU).**—This soil is level to gently sloping. It is in the northeastern part of the survey area. Included in mapping were areas of Adel soils and small intermittent lakes.

Permeability is moderately slow in this soil. Runoff is very slow, and the hazard of erosion is none to slight. Effective rooting depth is 36 to 60 inches. Available water holding capacity is 11 to 12 inches. Depth to a fluctuating water table is 0 to 10 inches.

This soil is used as wildlife habitat and timberland and for water supply. Dryland capability subclass VIIw; timber suitability group 12; wildlife habitat group H.

## Majada Series

The Majada series consists of well-drained soils that formed in material weathered from basalt and other volcanic debris on uplands. Slopes are 20 to 50 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,800 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 140 to 150 days. Associated soils are in the Apache, Montoso, and Silver series.

In a representative profile the surface layer is grayish-brown and dark grayish-brown stony and cobbly fine sandy loam about 7 inches thick. The subsoil is about 23 inches thick. It is dark grayish-brown very cobbly sandy

clay loam in the upper part, brown very cobbly sandy clay in the middle part, and pale-brown very cobbly sandy clay loam in the lower part. The substratum, to a depth of 60 inches or more, is light-gray and white very cobbly loam that has a high content of lime. The soil material is neutral to strongly alkaline. It is noncalcareous to a depth of 10 to 20 inches and calcareous below this depth.

Majada soils are used for range, as wildlife habitat, and for water supply. Areas covered by pinyon and juniper are a source of firewood and fence posts.

Representative profile of Majada stony fine sandy loam, 20 to 50 percent slopes, 1.7 miles southwest of Colorado Peak on the Caja del Rio Grant, SE $\frac{1}{4}$  sec. 6, T. 16 N., R. 7 E.:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) stony fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thick, platy structure and weak, fine, granular; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine vesicular pores; 20 percent stones and cobblestones; noncalcareous; neutral (pH 7.2); clear boundary, 2 to 4 inches thick.
- A12—3 to 7 inches, dark grayish-brown (10YR 4/2) cobbly fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, coarse, subangular blocky structure and moderate, medium, granular; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many fine roots; common fine and very fine interstitial pores; 20 percent cobblestones and gravel; noncalcareous; mildly alkaline (pH 7.4); clear boundary, 3 to 6 inches thick.
- B21t—7 to 14 inches, dark grayish-brown (10YR 4/2) very cobbly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate and strong, medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; common fine and few coarse roots; many fine tubular pores; thin clay films; 40 percent cobblestones and stones; noncalcareous; mildly alkaline (pH 7.8); clear boundary, 5 to 10 inches thick.
- B22t—14 to 19 inches, brown (10YR 5/3) very cobbly sandy clay, dark brown (10YR 3/3) when moist; strong, medium, angular blocky structure; very hard, very firm when moist, very sticky and plastic when wet; few fine and coarse roots; few fine tubular pores; thin clay films; 50 percent cobblestones and stones; slightly calcareous; mildly alkaline (pH 7.8); clear boundary, 3 to 8 inches thick.
- B3ca—19 to 30 inches, pale-brown (10YR 6/3) very cobbly sandy clay loam, dark brown (10YR 4/3) when moist; massive; very hard, very firm when moist, sticky and plastic when wet; few medium and coarse roots; few fine tubular pores; 70 percent cobblestones and stones; common, medium, prominent, white (10YR 8/1) lime nodules; strongly calcareous; strongly alkaline (pH 8.6); gradual boundary, 7 to 12 inches thick.
- Cca—30 to 60 inches, white (10YR 8/1) and light-gray (10YR 7/2) very cobbly loam, grayish brown (10YR 5/2) when moist; massive; hard, firm when moist, slightly sticky and slightly plastic when wet; 70 percent cobblestones and stones; no roots; coarse fragments weakly cemented by lime in the upper part; strongly calcareous; strongly alkaline (pH 8.8).

In the A horizon chroma is 2 or 3. In the B2t horizon hue is 10YR or 7.5YR, and value is 3 or 4 when moist. Texture in the B2t horizon ranges from sandy clay loam to clay loam or sandy clay that on an average is less than 35 percent clay. This horizon is 35 to 70 percent coarse fragments. In the Cca horizon hue ranges from 10YR to 7.5YR, and value ranges from 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. Cementation ranges from weak to strong in the Cca horizon. Cindery material ranges from 0 to 10 percent in the Cca horizon.

**Majada stony fine sandy loam, 20 to 50 percent slopes (MA).**—This soil is hilly to steep. It is in the north-

western part of the survey area. Included in mapping were areas of Apache soils and outcroppings of basalt.

Permeability is moderately slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 40 inches to the strong lime layer. Available water holding capacity is 2.5 to 3.5 inches.

This soil is used for range, as wildlife habitat, and for water supply. Areas covered with pinyon and juniper are a source of firewood and fenceposts. Basalt rock is used in landscaping and for building structures that help to control erosion. Dryland capability subclass VII<sub>s</sub>; Malpais range site; wildlife habitat group F.

## McVickers Series, Kaolinitic Variant

The McVickers series, kaolinitic variant, consists of moderately well drained soils on mountains. These soils formed in material weathered from sandstone and shale. Depth to bedrock is 40 to 60 inches or more. Slopes are 5 to 20 percent. The vegetation is mostly ponderosa pine and mixed conifers. Elevation ranges from 8,500 to 9,000 feet. The mean annual precipitation is 23 to 26 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 70 to 100 days. Associated soils are the Zuni variant, Borrego, Wilcoxson variant, and Fortwingate variant series.

In a representative profile the surface layer is brown sandy loam about 9 inches thick. The subsurface layer is pale-brown gravelly sandy clay loam about 5 inches thick. The subsoil is brownish-yellow clay and light clay to a depth of 60 inches or more. The soil material is medium acid throughout.

McVickers, kaolinitic variant, soils are used as timberland and wildlife habitat and for water supply.

Representative profile of McVickers sandy loam, kaolinitic variant, 7 miles north of La Cueva, SE $\frac{1}{4}$  sec. 14, T. 17 N., R. 11 E.:

- O1&O2—1 inch to 0, needles, leaves, twigs, and cones in various stages of decomposition.
- A1—0 to 9 inches, brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; soft, friable when moist, nonsticky and nonplastic when wet; many fine roots; common medium and fine interstitial pores; 5 percent cobblestones; medium acid (pH 5.8); clear boundary, 7 to 11 inches thick.
- A2—9 to 14 inches, pale-brown (10YR 6/3) gravelly sandy clay loam, dark brown (7.5YR 4/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; many fine and medium roots; common fine and medium tubular pores; 15 percent gravel and 5 percent cobblestones; medium acid (pH 5.8); abrupt boundary, 3 to 7 inches thick.
- B2t—14 to 48 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) when moist; few, medium, prominent, light-gray (5Y 7/2) mottles; moderate, fine and medium, subangular blocky structure; very hard, very firm when moist, sticky and plastic when wet; few medium and coarse roots; few fine tubular pores; moderately thick continuous clay films; medium acid (pH 5.8); gradual boundary, 30 to 40 inches thick.
- B3—48 to 60 inches, brownish-yellow (10YR 6/6) light clay, yellowish brown (10YR 5/6) when moist; common, medium, prominent, light-gray (5Y 7/2) mottles; massive; very hard, very firm when moist, sticky and plastic when wet; few medium and coarse roots; few fine tubular pores; medium acid (pH 5.4).

In the A1 horizon value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 2 or 3. In the A2 horizon hue is 10YR or



7.5YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the Bt2 horizon hue is 10YR or 7.5YR, and value is 6 or 7 when dry and 5 or 6 when moist. Chroma ranges from 4 to 6. The B2t horizon ranges from sandy clay to heavy clay loam or clay. Depth to bedrock is 40 to 60 inches or more.

**McVickers sandy loam, kaolinitic variant** (5 to 20 percent slopes) (MC).—This soil is moderately sloping to moderately steep. It is in the northeastern part of the survey area. Included in mapping were areas of Wilcoxson variant soils and sandstone outcroppings.

Permeability is slow on this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 7 to 9 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 1, 4, and 8; wildlife habitat group G.

## Mirabal Series

The Mirabal series consists of well-drained soils on mountains. Depth to granite and gneiss is 20 to 30 inches. Slopes are 5 to 100 percent. The vegetation is mostly conifers and an understory of brush and mid grasses. Elevation ranges from 8,000 to 9,500 feet. The mean annual precipitation is 18 to 20 inches, and the mean annual air temperature is 43° to 45° F. The frost-free season is 70 to 100 days. Associated soils are in the Chimayo, Supervisor, and Cundiyo series.

In a representative profile the surface layer is dark grayish-brown stony loam about 5 inches thick. The next layer is grayish-brown very stony loam about 4 inches thick. The substratum is brown very stony loam underlain by granite or gneiss bedrock at a depth of about 21 inches. The soil material is slightly acid throughout.

Mirabal soils are used as timberland and wildlife habitat and for water supply.

Representative profile of Mirabal stony loam, 30 to 70 percent slopes, about 1 mile north of Hyde Park, west of the Santa Fe Ski Basin road, NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 25, T. 18 N., R. 10 E.:

O1&O2—1 inch to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) when moist; strong, fine, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many medium interstitial pores; about 40 percent stones; noncalcareous; slightly acid (pH 6.4); clear boundary. 4 to 9 inches thick.

AC—5 to 9 inches, grayish-brown (10YR 5/2) very stony loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and medium roots; many fine and medium interstitial pores; about 60 percent stones; noncalcareous; slightly acid (pH 6.3); gradual boundary. 3 to 9 inches thick.

C—9 to 21 inches, brown (7.5YR 5/3) very stony loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine tubular pores; about 70 percent stones; noncalcareous; slightly acid (pH 6.3); abrupt boundary. 6 to 12 inches thick.

R—21 inches, partly fractured granite or gneiss bedrock.

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the AC and C horizons hue is 7.5YR or 10YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. The AC and C horizons range from sandy loam to loam. The content of coarse fragments ranges from 35 to 80 percent. Depth to granite or gneiss bedrock is 20 to 30 inches.

**Mirabal stony loam, 5 to 30 percent slopes** (MD).—This soil is moderately sloping to moderately steep. It is in the northeastern part of the survey area. Included in mapping were small areas of Chimayo and Supervisor soils and some rock outcroppings.

Permeability is moderately rapid in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 30 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 2 and 6; wildlife habitat group G.

**Mirabal stony loam, 30 to 70 percent slopes** (ME).—This soil is steep and very steep. It is in the northeastern part of the survey area. This soil has the profile described as representative for the series. Included in mapping are areas of Chimayo and Supervisor soils and rock outcroppings.

Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 20 to 30 inches. Available water holding capacity is 1.5 to 3 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 3 and 6; wildlife habitat group G.

**Mirabal-Rock outcrop complex, 40 to 100 percent slopes** (MF).—This complex consists of about 60 percent Mirabal stony loam and 30 percent Rock outcrop. The Mirabal soils are steep to very steep. Included soils make up the other 10 percent. These are Supervisor soils and some very shallow soils.

Permeability is moderately rapid in the Mirabal soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 20 to 30 inches. Available water holding capacity is 1.5 to 3 inches.

The soils in this complex are used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 3 and 6; wildlife habitat group G.

## Montoso Series

The Montoso series consists of well-drained soils that formed in cinders and other volcanic debris on cinder cones and hills. Slopes are 5 to 60 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 6,800 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Majada, Silver, Calabasas, and Panky series.

In a representative profile the surface layer is brown gravelly silt loam about 3 inches thick. The subsoil is about 9 inches thick. It is dark reddish-gray light silty clay loam in the upper part and dark reddish-gray very gravelly silty clay loam in the lower part. The substratum to a depth of 18 inches is dark reddish-gray very gravelly silt loam. Below this, to a depth of 60 inches or more, it

consists of weak-red cinders. The soil material is neutral to moderately alkaline. It is noncalcareous to a depth of 8 to 16 inches and calcareous below this depth.

Montoso soils are used for range, as wildlife habitat, and for water supply. The cinders are used for making building blocks and for landscaping.

Representative profile of Montoso gravelly silt loam, 30 to 60 percent slopes, 1.1 miles northeast of Cerro Micho on the Caja del Rio Grant, SE $\frac{1}{4}$  sec. 10, T. 17 N., R. 7 E.:

- A1—0 to 3 inches, brown (7.5YR 5/2) gravelly silt loam, dark brown (7.5YR 3/2) when moist; weak and moderate, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; many fine and very fine tubular pores; 20 percent gravel; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 5 inches thick.
- B1—3 to 6 inches, dark reddish-gray (5YR 4/2) light silty clay loam, dark reddish brown (5YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many fine and very fine roots; many fine and very fine tubular pores; 10 percent gravel; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 5 inches thick.
- B2t—6 to 12 inches, dark reddish-gray (5YR 4/2) very gravelly silty clay loam, dark reddish brown (5YR 3/2) when moist; weak, fine, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common fine and very fine roots; common fine tubular pores; common moderately thick clay films; 45 percent gravel; noncalcareous; mildly alkaline (pH 7.8); abrupt boundary. 5 to 10 inches thick.
- C1—12 to 18 inches, dark reddish-gray (5YR 4/2) very gravelly silt loam, dark reddish brown (5YR 3/2) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; common fine tubular pores; 80 percent gravel; noncalcareous to slightly calcareous; mildly alkaline (pH 7.8); clear boundary. 3 to 12 inches thick.
- C2ca—18 to 24 inches, weak-red (10R 5/2) lime-coated cinders, dusky red (10R 3/3) when moist; massive; few fine roots; many fine interstitial pores; strongly calcareous; moderately alkaline; (pH 8.2); clear boundary. 5 to 20 inches thick.
- C3—24 inches, weak-red (10R 5/2) cinders, dusky red (10R 3/3) when moist.

In the A and B horizons hue ranges from 2.5YR to 7.5YR, and value ranges from 3 to 5 when dry and is 2 or 3 when moist. Chroma is 2 or 3. The B2t horizon ranges from very gravelly (cindery) heavy loam to heavy silt loam to clay loam or silty clay loam. The content of cinders ranges from 35 to 90 percent in the B2t and C1 horizons. In the C horizon hue ranges from 5YR to 10R, mainly because of the color of the cinders. Depth to cinders (C2ca horizon) is 12 to 32 inches.

**Montoso gravelly silt loam, 5 to 30 percent slopes (MG).**—This soil is moderately sloping to moderately steep. It is in the northwestern part of the survey area. This soil has a profile similar to that described as representative for the series, except that the depth to cinders is about 30 inches.

Included with this soil in mapping were small areas of Majada, Apache, and Guaje soils and a small acreage of Montoso gravelly silt loam, 30 to 60 percent slopes.

Permeability is moderate in this soil. Runoff is slow, and the hazard of erosion is moderate. Effective rooting depth is 20 to 32 inches. Available water holding capacity is 2 to 4 inches.

This soil is used mostly for range and as wildlife habitat. In a few areas the pinyon and juniper are used for firewood and fenceposts. The cinders are used as a covering for roofs, to accent landscaping in yards, and for making building blocks. Dryland capability subclass VIIe; Cinder range site; wildlife habitat group F.

**Montoso gravelly silt loam, 30 to 60 percent slopes (MH).**—This soil is steep to very steep. It is in the northwestern part of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Majada soils and small areas of basalt outcroppings.

Permeability is moderate in this soil. Runoff is slow, and the hazard of erosion is severe. Effective rooting depth is 12 to 32 inches. Available water holding capacity is 2 to 4 inches.

This soil is used mostly for range and as wildlife habitat. A few areas are used as a source of firewood and fenceposts. The cinders are used as a covering for roofs, to accent landscaping in yards, and for making building blocks. Dryland capability subclass VIIe; Cinder range site; wildlife habitat group F.

## Moriarty Series

The Moriarty series consists of well-drained soils that formed in mixed alluvium on side slopes and terraces. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Pre-witt, Hagerman, and Galisteo series.

In a representative profile the surface layer is reddish-brown silty clay about 6 inches thick. The next layer is reddish-brown clay about 24 inches thick. The substratum, to a depth of 60 inches or more, is weak-red clay. The soil material is calcareous and moderately alkaline.

Moriarty soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Moriarty silty clay,  $5\frac{1}{2}$  miles south and 1 mile east of White Lakes, SE $\frac{1}{4}$  sec. 4, T. 10 N., R. 11 E.:

- A1—0 to 6 inches, reddish-brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) when moist; moderate, medium, angular blocky structure; hard, friable when moist, slightly sticky and plastic when wet; common fine and very fine roots; common fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 8 inches thick.
- AC—6 to 30 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak, coarse, prismatic structure and moderate, medium, angular blocky; very hard, very firm when moist, very sticky and plastic when wet; few very fine roots; common fine tubular pores; common intersecting slickensides; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 18 to 36 inches thick.
- C—30 to 60 inches, weak-red (10R 5/4) clay, weak red (10R 4/4) when moist; massive; very hard when dry, very firm when moist, very sticky and plastic when wet; very few fine roots; few fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the AC and C horizons hue is 10R or 2.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. The AC and C horizons range from heavy silty clay loam or silty clay to clay. Strata of medium to fine texture and 5 to 10 percent gravel are common below a depth of 40 inches. Weak accumulations of carbonates and gypsum, totaling no more than 15 percent, are in the lower part of the C horizon in places.

**Moriarty silty clay (0 to 5 percent slopes) (MO).**—This soil is level to gently sloping. It is in the southern part

of the survey area. Included in mapping were areas of Galisteo, La Brier, and Prewitt soils.

Permeability is very slow in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 7 to 9 inches. This soil receives extra water from the adjacent soils. It is generally dissected by one or more gullies.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass Vlew; Clayey range site; wildlife habitat group E.

## Nambe Series

The Nambe series consists of well-drained soils that formed in glacial till derived from granite, gneiss, and schist. Slopes are 20 to 100 percent. The vegetation is mostly Engleman spruce and a sparse understory of mid grasses and forbs. Elevation ranges from 10,000 to 12,000 feet. The mean annual precipitation is 35 to 40 inches, and the mean annual air temperature is 40° to 42° F. The frost-free season is 40 to 60 days. Associated soils are in the Lunch variant, Penitente, and Bobtail series.

In a representative profile the surface layer is very dark grayish-brown gravelly loam about 3 inches thick. The subsurface layer is brown stony loam about 5 inches thick. The subsoil is light-brown stony and very stony sandy loam about 16 inches thick. The substratum, to a depth of 60 inches or more, is brown very stony sandy loam. The soil material is very strongly acid.

Nambe soils are used as timberland and wildlife habitat and for recreation and water supply.

Representative profile of Nambe gravelly loam, 30 to 50 percent slopes, 1 mile east of the Santa Fe Ski Basin, NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 15, T. 18 N., R. 11 E.:

O1—2 inches to 1 inch, undecomposed organic matter consisting mainly of needles, twigs, and bark.

O2—1 inch to 0, partly decomposed organic matter.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, fine, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and medium roots; many very fine to medium interstitial pores; approximately 15 percent gravel and 10 percent stones; very strongly acid (pH 5.0); clear, smooth boundary. 1 to 4 inches thick.

A2—3 to 8 inches, brown (7.5YR 5/4) stony loam, dark brown (7.5YR 4/2) when moist; weak, fine and medium, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common medium and fine roots; many fine to medium tubular pores; approximately 15 percent stones; very strongly acid (pH 4.4); clear, wavy boundary. 4 to 6 inches thick.

B21ir—8 to 18 inches, light-brown (7.5YR 6/4) stony sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common fine interstitial pores; approximately 30 percent stones; undersides of the stones have dark coatings presumed to be humus and iron oxides; very strongly acid (pH 5.0); gradual, wavy boundary. 8 to 14 inches thick.

B22ir—18 to 24 inches, light-brown (7.5YR 6/4) very stony sandy loam, brown (7.5YR 4/4) when moist; weak, fine subangular blocky structure; hard, friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine interstitial pores; approximately 60 percent stones; stones have reddish-brown coatings presumed to be humus and iron oxides; cementation in places; very strongly acid (pH 5.0); gradual, wavy boundary. 5 to 12 inches thick.

C—24 to 60 inches, brown (10YR 5/3) very stony sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; no roots; few fine interstitial pores; approximately 60 percent stones; very strongly acid (pH 5.0).

In the A1 horizon hue is 10YR or 7.5YR, and value ranges from 3 to 5 when dry and is 2 or 3 when moist. Chroma ranges from 1 to 3 in this horizon. In the A2 horizon hue is 10YR or 7.5YR, and value ranges from 5 to 7 when dry and is 4 or 5 when moist. Chroma ranges from 2 to 4.

In the B21ir horizon hue is 7.5YR or 5YR, and value ranges from 4 to 6 when dry and 3 to 4.5 when moist. Chroma ranges from 2 to 4. In the B22ir horizon hue ranges from 7.5YR to 2.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 3 to 5. The B21ir and B22ir horizons are generally sandy loam but range from 7 to 18 percent in clay, from 10 to 40 percent in silt, and from 50 to 75 percent in sand.

The content of stones ranges from 30 to 50 percent in the A1, A2, and B21ir horizons and from 50 to 80 percent in the B22ir and C horizons.

### Nambe gravelly loam, 30 to 50 percent slopes (NA).—

This steep soil is in the northeastern part of the survey area. It has the profile described as representative for the series. Included in mapping were areas of Penitente and Bobtail soils.

Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 4 to 5 inches.

This soil is used as timberland and wildlife habitat and for recreation and water supply. Dryland capability subclass VIIe; timber suitability group 10; wildlife habitat group G.

### Nambe stony loam, 20 to 60 percent slopes (NB).—

This soil is moderately steep to very steep. It is in the northeastern part of the survey area. The soil has a stony loam surface layer, but the profile is otherwise similar to that described as representative of the series. Included in mapping were areas of Penitente and Bobtail soils.

Permeability is moderately rapid in this soil. Runoff is medium to rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 4 to 5 inches.

This soil is used as timberland and wildlife habitat and for recreation and water supply. Dryland capability subclass VIIe; timber suitability groups 5, 8, and 11; wildlife habitat group G.

### Nambe stony loam, 20 to 70 percent slopes, eroded (NE).—

This soil is moderately steep to very steep. It has a stony loam surface layer, but the profile is otherwise similar to that described as representative of the series. This soil is in the northeastern part of the survey area.

Various stages of sheet, rill, and gully erosion are present, and some gullies are 3 to 4 feet deep. In places erosion has removed much of the original surface layer and has exposed stones and boulders that cover about 15 to 25 percent of the present surface. Included in mapping were areas of Penitente and Bobtail soils that make up about 10 percent of the acreage.

Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 4 to 5 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability group 11; wildlife habitat group G.

**Nambe-Rock outcrop complex, 20 to 50 percent slopes (NM).**—This complex consists of about 65 percent Nambe stony loam and 25 percent Rock outcrop. The Nambe soils are moderately steep to steep and are intermingled with the Rock outcrop. Included soils make up the other 10 percent. These are Penitente and Bobtail soils and some very shallow soils.

The Nambe soil has a profile similar to that described as representative for the Nambe series, except that the surface layer is stony loam. Permeability is moderately rapid in this soil. Runoff is medium to rapid, and the hazard of erosion is moderate. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 3 to 5 inches.

The soils in this complex are used as timberland and wildlife habitat and for water supply. Dryland capability subclass VII<sub>s</sub>; timber suitability group 11; wildlife habitat group G.

**Nambe-Rock outcrop complex, 50 to 100 percent slopes (NR).**—This complex consists of about 65 percent Nambe stony loam and 25 percent Rock outcrop. The Nambe soils are very steep and are intermingled with the Rock outcrop. Included soils make up the other 10 percent. These are Penitente and Bobtail soils and, in places, very shallow soils.

The Nambe soil has a profile similar to that described as representative for the Nambe series, except that the surface layer is stony loam. Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 3 to 5 inches.

The soils in this complex are used as timberland and wildlife habitat and for water supply. Dryland capability subclass VII<sub>s</sub>; timber suitability group 12; wildlife habitat group G.

## Ortiz Series

The Ortiz series consists of well-drained soils that formed in material weathered from shale on ridges and hills. Depth to shale is 20 to 40 inches. Slopes are 5 to 40 percent. The vegetation is mostly mid grasses, shrubs, and trees. Elevation ranges from 7,000 to 8,000 feet. The mean annual precipitation is 14 to 16 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 120 to 130 days. Associated soils are in the Cueva, Encierro, Wilcoxson variant, and Laporte series.

In a representative profile the surface layer is dark reddish-gray and reddish-brown gravelly loam about 8 inches thick. The subsoil is light reddish-brown light clay loam about 15 inches thick. The substratum is light reddish-brown gravelly loam. Weathered shale is at a depth of about 28 inches. The soil material is calcareous. It is moderately alkaline to strongly alkaline.

Ortiz soils are used for range, as wildlife habitat, and for water supply. The pinyon and juniper trees on these soils are a source of firewood and fenceposts.

Representative profile of Ortiz gravelly loam, 5 to 40 percent slopes, 4 miles north and 1 mile west of Ojo de La Vaca, SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 29, T. 15 N., R. 11 E.:

A11—0 to 3 inches, dark reddish-gray (5YR 4/2) gravelly loam, dark reddish brown (5YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; many very fine and fine interstitial pores; 15 percent gravel; slightly calcareous; mod-

erately alkaline (pH 8.0); abrupt boundary. 2 to 5 inches thick.

A12—3 to 8 inches, reddish-brown (5YR 5/3) gravelly loam, dark reddish brown (5YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine and very fine interstitial pores; 20 percent gravel; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 3 to 8 inches thick.

B2ca—8 to 23 inches, light reddish-brown (5YR 6/3) light clay loam, reddish brown (5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; common medium and few fine roots; many fine and few very fine interstitial pores; 10 percent gravel; irregularly shaped segregations and seams of lime; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 10 to 24 inches thick.

C1ca—23 to 28 inches, light reddish-brown (5YR 6/3) gravelly loam, reddish brown (5YR 4/3) when moist; massive; slightly hard, friable when moist, nonsticky and nonplastic when wet; very few roots; few fine interstitial pores; 20 percent gravel; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 5 to 12 inches thick.

C2—28 inches, light-gray variegated with red and green, weakly weathered, strongly calcareous shale that becomes less weathered with depth.

In the A horizon value is 2 or 3 when moist, and chroma is 2 or 3. In the B2ca horizon hue ranges from 2.5YR to 7.5YR, and value ranges from 5 to 7 when dry and is 4 or 5 when moist. Chroma ranges from 2 to 4. The B2ca horizon ranges from gravelly heavy loam to gravelly light clay loam. In the C1ca horizon hue is 5YR or 7.5YR, and value ranges from 6 to 8 when dry and is 4 or 5 when moist. Chroma ranges from 2 to 4. Depth to weathered shale ranges from 20 to 40 inches.

**Ortiz gravelly loam, 5 to 40 percent slopes (OG).**—This soil is gently rolling to steep. It is in the eastern part of the survey area. Included in mapping were areas of Cueva, Laporte, and Wilcoxson variant soils and outcroppings of weathered sandstone and shale.

Permeability is moderately slow in this soil. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Effective rooting depth is 20 to 40 inches. Available water holding capacity is 4 to 5.5 inches.

This soil is used for range, as wildlife habitat, and for water supply. Where this soil is covered with pinyon and juniper, it is a source of firewood and fenceposts. Dryland capability subclass VII<sub>e</sub>; Mountain Shale range site; wildlife habitat group F.

## Otero Series

The Otero series consists of well-drained soils that formed in wind-laid sands or in water-laid deposits reworked by wind on alluvial fans. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Palma, Harvey, and Penistaja series.

In a representative profile the surface layer is brown fine sandy loam about 6 inches thick. The substratum is light-brown fine sandy loam to a depth of 60 inches or more. The soil material is mildly alkaline to moderately alkaline, and it is calcareous throughout.

Otero soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Otero fine sandy loam in an area of Otero-Palma fine sandy loams, 1 to 9 percent slopes, 5 miles east and 3 miles south of Stanley, 0.4 mile north of a farm road intersection, SE $\frac{1}{4}$  sec. 8, T. 10 N., R. 10 E.:

A1—0 to 6 inches, brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) when moist; weak, fine, subangular blocky structure and structureless (single grained); soft when dry, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; slightly calcareous; mildly alkaline (pH 7.8); clear boundary. 4 to 8 inches thick.

AC—6 to 14 inches, light-brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; very weak, fine, subangular blocky structure and weak, fine, granular; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common fine tubular pores; strongly calcareous; mildly alkaline (pH 7.8); clear boundary. 6 to 10 inches thick.

Cca—14 to 60 inches, light-brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2).

In the A horizon value ranges from 5 to 7 when dry and is 4 or 5 when moist. Chroma ranges from 2 to 4. In the AC and Cca horizons hue is 7.5YR or 10YR, and value is 6 or 7 when dry and 4 or 5 when moist. Chroma is 3 or 4. The AC and C horizons range from loamy very fine sand to fine sandy loam. These soils are typically calcareous throughout the profile, but in places the upper 6 inches is free of lime.

**Otero-Palma fine sandy loams, 1 to 9 percent slopes (OP).**—This complex consists of about 40 percent Otero fine sandy loam intermingled with about 40 percent Palma fine sandy loam. These soils are gently undulating to gently rolling. Included soils make up the other 20 percent. Of these soils, 10 percent is Hagerman fine sandy loam that has slopes of 0 to 5 percent, and the remaining 10 percent is Harvey, Dean, and La Brier soils. This complex is in the extreme southern part of the survey area.

Permeability is moderately rapid in the Otero soil. Runoff is slow, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 7.5 to 9 inches.

The Palma soil has the profile described as representative for the Palma series. Permeability is moderately rapid in this soil. Runoff is slow, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 7.5 to 9 inches.

These soils are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

## Palma Series

The Palma series consists of well-drained soils that formed in mixed wind-laid deposits on uplands. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Otero, Harvey, and Penistaja series.

In a representative profile the surface layer is reddish-brown fine sandy loam about 7 inches thick. The subsoil is reddish-brown heavy fine sandy loam and fine sandy loam about 13 inches thick. The substratum, to a depth of

60 inches or more, is reddish-brown fine sandy loam. The soil material is noncalcareous to a depth of 12 to 25 inches and is calcareous below this depth. Reaction is neutral to moderately alkaline.

Palma soils are used for range, as wildlife habitat, and for water supply. They are present only as part of a complex with Otero soils.

Representative profile of Palma fine sandy loam in an area of Otero-Palma fine sandy loams, 1 to 9 percent slopes, 5 miles east and 3 miles south of Stanley, 50 yards north of a farm road intersection, SE $\frac{1}{4}$  sec. 8, T. 10 N., R. 10 E.:

A1—0 to 3 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; noncalcareous; neutral (pH 7.2); clear boundary. 2 to 4 inches thick.

A3—3 to 7 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; very few fine and medium tubular pores; noncalcareous; mildly alkaline (pH 7.4); clear boundary. 0 to 4 inches thick.

B2t—7 to 16 inches, reddish-brown (5YR 5/4) heavy fine sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure and weak, fine, granular; soft, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; very few tubular pores; thin patchy clay films and clay coatings on sand grains and on bridges between sand grains; noncalcareous; mildly alkaline (pH 7.6); clear boundary. 7 to 12 inches thick.

B3—16 to 20 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; very few fine roots; very few fine tubular pores; noncalcareous; moderately alkaline (pH 7.9); clear boundary. 3 to 5 inches thick.

Cca—20 to 60 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish-brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; few fine tubular pores; few calcium carbonate concretions, thin seams, and streaks; strongly calcareous; moderately alkaline (pH 8.2).

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 2.5YR or 5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. The B2t horizon ranges from light loam to heavy fine sandy loam. In the Cca horizon hue ranges from 5YR to 2.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4.

## Panky Series

The Panky series consists of well-drained soils that formed in mixed old alluvium on alluvial fans. Slopes are 0 to 9 percent. The vegetation is mostly mid grasses and shrubs. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Harvey, Agua Fria, Cerrillos, and Pojoaque series.

In a representative profile the surface layer is light-brown fine sandy loam about 3 inches thick. The subsoil is reddish-brown loam and heavy clay loam about 21 inches thick. The substratum, to a depth of 60 inches or more, is pinkish-white sandy clay loam that has a high content of

lime. The soil material is mildly alkaline to strongly alkaline. It is noncalcareous to a depth of 10 to 20 inches and calcareous below this depth.

Panky soils are mostly used for range, as wildlife habitat, and for water supply. A few areas are used for community development.

Representative profile of Panky fine sandy loam, in an unsectioned grant within the city limits of Santa Fe, 50 feet northwest of intersection of St. Michael's Drive and the Santa Fe Railroad:

- A1—0 to 3 inches, light-brown (7.5YR 6/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, thin and thick, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; noncalcareous; mildly alkaline (pH 7.7); clear boundary. 2 to 5 inches thick.
- B1—3 to 6 inches, reddish-brown (5YR 5/3) loam, reddish brown (5YR 4/3) when moist; strong, fine and medium, granular structure; soft, very friable when moist, slightly sticky and plastic when wet; common fine roots; few very fine tubular pores; few thin clay films; noncalcareous; mildly alkaline (pH 7.7); clear boundary. 2 to 5 inches thick.
- B21t—6 to 9 inches, reddish-brown (5YR 4/3) heavy clay loam, dark reddish brown (5YR 3/3) when moist; strong, fine and medium, angular and subangular blocky structure; hard, friable when moist, very sticky and plastic when wet; many very fine roots; many very fine tubular pores; thin continuous clay films; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 5 inches thick.
- B22t—9 to 13 inches, reddish-brown (5YR 4/3) heavy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; few very fine tubular pores; few discontinuous clay films; noncalcareous; moderately alkaline (pH 8.4); clear boundary. 3 to 6 inches thick.
- B3tca—13 to 24 inches, reddish-brown (5YR 5/4) heavy clay loam, reddish brown (5YR 4/4) when moist; weak, fine and medium, angular and subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; few fine roots; very few fine tubular pores; thin patchy clay films; common fine nodules and soft masses of lime; strongly calcareous; moderately alkaline (pH 8.4); abrupt boundary. 8 to 13 inches thick.
- Cca—24 to 60 inches, pinkish-white (7.5YR 8/2) sandy clay loam, pinkish gray (7.5YR 7/2) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; no roots; few fine and very fine tubular pores; 40 to 60 percent disseminated calcium carbonate; strongly calcareous; strongly alkaline (pH 8.6).

In the A horizon value is 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B2t horizon ranges from heavy clay loam to light clay. The lower part of the B2t horizon ranges from noncalcareous to moderately calcareous. In the Cca horizon hue is 7.5YR or 5YR, and value ranges from 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. The depth to the Cca horizon ranges from 20 to 34 inches.

**Panky fine sandy loam** (0 to 5 percent slopes) (Pd) (PB).—This soil is level to gently sloping. It is in the north-central part of the survey area. This soil is mapped at both high and low intensity, but it is mostly in the low-intensity area.

Included with this soil in mapping were areas of Agua Fria, Cerrillos, Pojoaque, and Fivemile soils in the low-intensity survey and areas of Agua Fria and Cerrillos soils in the high-intensity survey.

Permeability is slow in this soil. Runoff is medium, and

the hazard of erosion is moderate. Effective rooting depth is about 40 inches. Available water holding capacity is 4 to 5 inches.

This soil is used mostly for range, as wildlife habitat, and for water supply. A few areas are used for community development. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

## Pastura Series

The Pastura series consists of well-drained soils that formed in mixed alluvium on upland ridges. Depth to indurated caliche is 8 to 20 inches. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Dean, Tapia, Clovis, and Witt series.

In a representative profile the surface layer is brown loam about 9 inches thick. The substratum, about 7 inches thick, is light-gray gravelly loam underlain by pinkish-white indurated caliche. The soil material is calcareous and moderately alkaline to strongly alkaline.

Pastura soils are used for range, as wildlife habitat, and for water supply. They are mapped only as part of a complex with Dean soils.

Representative profile of Pastura loam in an area of Dean-Pastura loams, 1 to 9 percent slopes, 1½ miles north of the Torrance County line, SE¼ sec. 30, T. 10 N., R. 9 E.:

- A1—0 to 9 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; few fine tubular pores; 5 to 10 percent gravel; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 4 to 10 inches thick.
- C1—9 to 16 inches, light-gray (10YR 7/2) gravelly loam, pale brown (10YR 6/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, nonsticky and nonplastic; common very fine roots; few very fine tubular pores; 20 to 50 percent hard caliche fragments less than 3 inches in diameter; strongly calcareous; strongly alkaline (pH 8.8); abrupt boundary. 4 to 10 inches thick.
- C2cam—16 inches, pinkish-white (7.5YR 8/2) to very pale brown (10YR 8/3) indurated caliche that has a laminar upper surface.

In the A horizon value ranges from 5 to 7 when dry and 3 to 5 when moist. Chroma ranges from 2 to 4. In the C horizon hue is 7.5YR or 10YR, and value ranges from 6 to 8 when dry and is 5 or 6 when moist. Chroma ranges from 2 to 4. The C horizon ranges from loam or gravelly loam to light clay loam or gravelly light clay loam. Depth to indurated caliche ranges from 8 to 20 inches. The hardness of the caliche gradually decreases with depth and becomes soft or weakly cemented at a depth of 1 to 3 feet below the upper surface of the C2cam horizon.

## Pena Series

The Pena series consists of well-drained soils that formed in mixed alluvium or alluvial fans. Depth to weakly cemented very gravelly loam is 12 to 30 inches. Slopes are 1 to 25 percent. The vegetation is mostly mid grasses and trees. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Rednun, Witt, and Chimayo series.



In a representative profile the surface layer is dark reddish-brown stony clay loam about 13 inches thick. The substratum to a depth of about 24 inches is pinkish-gray very gravelly clay loam. Below this, to a depth of 60 inches or more, it is pinkish-gray very gravelly loam that is 70 to 90 percent gravel, cobblestones, and stones. The latter are weakly cemented in a zone that has a high content of lime. The soil material is calcareous and moderately alkaline throughout.

Pena soils are used for range, as wildlife habitat, and for water supply. The pinyon and juniper trees on these soils are a source of firewood and fenceposts.

Representative profile of Pena stony clay loam, 1 to 25 percent slopes, 6 miles south of Los Cerrillos, in the unsectioned Ortiz Mine Grant; at Dolores Mine near the headquarters of Dolores Ranch:

A1—0 to 13 inches, dark reddish-brown (5YR 3/3) stony clay loam, dark reddish brown (5YR 2/2) when moist; weak, medium and coarse, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; many medium and fine roots; common medium and fine tubular pores; 35 percent cobblestones and stones; slightly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 15 inches thick.

C1ca—13 to 24 inches, pinkish-gray (7.5YR 6/2) very gravelly clay loam, dark brown (7.5YR 4/2) when moist; weak, fine and medium, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; 40 percent igneous gravel; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 8 to 15 inches thick.

C2ca—24 to 60 inches, pinkish-gray (7.5YR 7/2) weakly cemented very gravelly loam, brown (7.5YR 5/2) when moist; massive; 40 percent gravel and 30 percent cobblestones and stones weakly cemented with calcium carbonate; moderately alkaline (pH 8.3).

In the A horizon value is 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the Cca horizon hue is 5YR or 7.5YR, and value ranges from 6 to 8 when dry and 4 to 6 when moist. Chroma is 2 or 3. Depth of soil above the weakly cemented lime zone ranges from 12 to 30 inches.

**Pena stony clay loam, 1 to 25 percent slopes (PC).**—This soil is nearly level to moderately steep. It is in the southwestern part of the survey area. Included in mapping are areas of Rednun and Agua Fria soils and sandstone, shale, and igneous rock outcrops.

Permeability is moderate in this soil. Runoff is slow to rapid, and the hazard of erosion is moderate to severe. Effective rooting depth is 12 to 30 inches. Available water holding capacity is 2.5 to 3.5 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; Shallow range site; wildlife habitat group F.

## Penistaja Series

The Penistaja series consists of well-drained soils that formed in mixed water-laid and wind-laid material on alluvial fans. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Hagerman, Otero, Palma, and Rednun series.

In a representative profile the surface layer is brown fine sandy loam about 3 inches thick. The subsoil is red-

dish-brown and light-brown sandy clay loam about 27 inches thick. The substratum, to a depth of 60 inches or more, is light-brown very fine sandy loam that has a high content of lime. The soil material is moderately alkaline. It is noncalcareous to a depth of 10 to 16 inches and calcareous below this depth.

Penistaja soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Penistaja fine sandy loam, 0 to 5 percent slopes, 2 miles north and 6 miles west of White Lakes, in the unsectioned San Cristoval Grant, 4 miles east of State Route No. 41:

A1—0 to 3 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many medium and fine roots; few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 4 inches thick.

B2t—3 to 13 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/3) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky; hard, friable when moist, sticky and plastic when wet; few fine roots; few fine and very fine tubular pores; thin, patchy clay films; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 8 to 12 inches thick.

B3ca—13 to 30 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; weak, coarse, prismatic and weak, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; common fine and very fine tubular pores; disseminations and a few concretions of lime; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 12 to 24 inches thick.

Cca—30 to 60 inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) when moist; massive; hard, friable when moist, nonsticky and nonplastic when wet; very few very fine roots; common fine and very fine tubular pores; disseminations and common concretions of lime; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B2t horizon ranges from light sandy clay loam to heavy sandy clay loam. The Cca horizon has a hue of 7.5YR or 5YR and value of 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. These soils are generally free of lime to a depth below the B2t horizon, but in places the B2t horizon is slightly calcareous. Sandstone is below a depth of 40 inches in places but is commonly at a depth of more than 60 inches.

**Penistaja fine sandy loam, 0 to 5 percent slopes (PD).**—This soil is level to gently sloping. It is in the southern part of the survey area. Included in mapping were areas of Rednun, Otero, Palma, and Harvey soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 8.5 to 10 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

## Penitente Series

The Penitente series consists of well-drained soils on high mountain tops. These soils formed in glacial till derived from granite, gneiss, and schist. Slopes are 0 to 30



percent. The vegetation is mostly mid grasses, shrubs, and forbs. Elevation ranges from 12,000 to 12,700 feet. The mean annual precipitation is 40 to 50 inches, and the mean annual air temperature is 38° to 42° F. The frost-free season is 30 to 50 days. Associated soils are in the Nambe and Bobtail series.

In a representative profile the surface layer is very dark gray and dark-brown cobbly loam about 13 inches thick. The subsoil is brown very stony loam about 11 inches thick. The substratum, to a depth of 60 inches or more, is brown very stony loam. The soil material is strongly acid or very strongly acid (fig. 8).

Penitente soils are used as wildlife habitat and for range and water supply.

Representative profile of Penitente cobbly loam, 0 to 30 percent slopes, about 2 miles east of Santa Fe Basin Ski Lodge, SW $\frac{1}{4}$  sec. 10, T. 18 N., R. 11 E.:

- O1 & O2—1 inch to 0, organic mat of undecomposed and partly decomposed plant remains, mostly roots and leaves.
- A11—0 to 10 inches, very dark gray (10YR 3/1) cobbly loam, black (10YR 2/1) when moist; strong, fine, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine vesicular pores; approximately 20 percent cobblestones; strongly acid (pH 5.2); clear boundary. 6 to 16 inches thick.
- A12—10 to 13 inches, dark-brown (7.5YR 3/2) cobbly loam, very dark brown (7.5YR 2/2) when moist; weak, fine, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine tubular pores; approximately 40 percent cobblestones; strongly acid (pH 5.1); clear boundary. 2 to 4 inches thick.
- B2ir—13 to 24 inches, brown (7.5YR 5/3) very stony loam, brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist; nonsticky and nonplastic when wet; few fine roots; common fine interstitial pores; approximately 70 percent stones; very strongly acid (pH 5.0); gradual boundary. 8 to 16 inches thick.
- C—24 to 60 inches, brown (7.5YR 5/2) very stony loam, dark brown (7.5YR 4/2) when moist; massive; slightly

hard, very friable when moist, nonsticky and nonplastic when wet; very few fine roots; common fine interstitial pores; approximately 70 percent stones; very strongly acid (pH 5.0).

In the A horizon value is 3 or 4 when dry and 2 or 3 when moist. Chroma ranges from neutral to 2. In the B2ir horizon hue is 7.5YR or 5YR, and value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B2ir horizon ranges from loam to silt loam or light clay loam. In the C horizon hue is 10YR or 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 2 or 3. The content of stone ranges from 50 to 80 percent in the B and C horizons.

#### Penitente cobbly loam, 0 to 30 percent slopes (PE).—

This soil is level to moderately steep. It is in the north-eastern part of the survey area. Included in mapping were areas of Nambe soils and Rock outcrop.

Permeability is moderately rapid in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 5 to 6 inches.

This soil is used as wildlife habitat and for water supply and range. Dryland capability subclass VIIe; Alpine Slopes range site; wildlife habitat group G.

### Persayo Series

The Persayo series consists of well-drained soils on upland ridges and hills. Depth to shale is 6 to 16 inches. Slopes are 3 to 25 percent. The vegetation is mostly mid grasses, shrubs, and scattered junipers. Elevation ranges from 5,800 to 6,200 feet. The mean annual precipitation is 11 to 13 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Galisteo and Las Lucas series.

In a representative profile the surface layer is light brownish-gray channery clay loam about 3 inches thick. The next layer is light brownish-gray channery silty clay loam underlain by weathered shale and sandstone fragments at a depth of about 12 inches. The soil material is moderately alkaline.

Persayo soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Persayo channery clay loam in an area of Persayo-Shale rock land association, rolling, 2.5 miles northwest of Los Cerrillos, in the center of sec. 2, T. 14 N., R. 7 E.:

- A1—0 to 3 inches, light brownish-gray (2.5Y 6/2) channery clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; 25 percent sandstone channers; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 6 inches thick.
- AC—3 to 12 inches, light brownish-gray (2.5Y 6/2) channery silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; few fine tubular pores; 30 percent sandstone channers; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 10 inches thick.
- C—12 inches, weathered shale and sandstone channers embedded within a high lime zone that contains gypsum.

In the A horizon value is 5 to 7 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the AC horizon hue is 2.5Y or 5Y, and value ranges from 6 to 8 when dry and 3 to 5 when moist. Chroma is 2 or 3. The AC horizon ranges from channery clay loam to channery silty clay loam. Depth to shale ranges from 6 to 16 inches.



Figure 8.—Profile of Penitente cobbly loam, 0 to 30 percent slopes.

**Persayo-Shale rock land association, rolling (PH).**—This association is in the central part of the survey area. It consists of about 60 percent Persayo channery clay loam that has slopes of 3 to 25 percent and about 30 percent Shale rock land. The latter is on ridgetops and steep side slopes.

Included with this association in mapping were areas of very dark recent alluvium along drainageways. Also, some exposed intrusive dikes are scattered throughout the areas. These inclusions make up about 10 percent of the mapped areas.

Permeability is moderate in the Persayo soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 6 to 16 inches. Available water holding capacity is 1 to 1.5 inches.

This association is used for range, as a source of water, and as wildlife habitat. Persayo soil: Dryland capability subclass VII<sub>s</sub>; Shallow range site; wildlife habitat group A. Shale rock land: Dryland capability subclass VIII<sub>s</sub>; not assigned to a wildlife habitat group.

## Pojoaque Series

The Pojoaque series consists of well-drained soils on upland terraces. These soils formed in old alluvium that has been reworked by water. Slopes are 5 to 25 percent. The vegetation is mostly mid grasses, shrubs, and pinyon and juniper. Elevation ranges from 6,600 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 50° F. The frost-free season is 160 to 170 days. Associated soils are in the Panky, Cerrillos, Agua Fria, and Harvey series.

In a representative profile the surface layer is light reddish-brown sandy clay loam about 7 inches thick. The substratum is light reddish-brown gravelly sandy clay loam to a depth of 60 inches or more. The soil material is calcareous, and it is mildly alkaline.

Pojoaque soils are used for range, community development, and water supply.

Representative profile of Pojoaque sandy clay loam in an area of Pojoaque-Rough broken land complex, north of the city limits of Santa Fe along Tano Road, NE $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 3, T. 17 N., R. 9 E.:

A1—0 to 7 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine and very fine tubular pores; 5 to 10 percent rounded igneous gravel; strongly calcareous; mildly alkaline (pH 7.6); clear boundary. 4 to 8 inches thick.

C1ca—7 to 25 inches, light reddish-brown (5YR 6/4) gravelly sandy clay loam, reddish brown (5YR 5/4) when moist; massive; slightly hard, friable when moist, sticky and plastic when wet; few fine roots; common fine and very fine tubular pores; 25 percent rounded igneous gravel; disseminations of lime and numerous blotches; slightly calcareous; mildly alkaline (pH 7.8); diffuse boundary. 12 to 30 inches thick.

C2ca—25 to 60 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine and very fine tubular pores; 15 percent rounded igneous gravel; disseminations of lime; slightly calcareous; mildly alkaline (pH 7.8); 24 inches to many feet thick.

In the A horizon and C horizon, to a depth of 40 inches, hue ranges from 5YR to 10YR, and value ranges from 5 to 7 when

dry and 4 to 6 when moist. Chroma is 3 or 4. In the C horizon, below a depth of 40 inches, hue is 5YR or 7.5YR, and value and chroma are the same as in the upper 40 inches. The Cca horizon ranges from gravelly heavy loam to gravelly sandy clay loam. Strata of sand and gravel are common below a depth of 40 inches. Layers of siltstone and semi-indurated sandstone occur sporadically in the substratum.

**Pojoaque-Panky association, rolling (PK).**—This association consists of about 60 percent Pojoaque sandy clay loam that has slopes of 5 to 25 percent and 35 percent Panky loam that has slopes of 0 to 9 percent. Included soils make up the remaining 5 percent. These are Bluewing, Cerrillos, and Agua Fria soils.

Permeability is moderate in the Pojoaque soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 8 to 9.5 inches.

The Panky soil has a profile similar to that described as representative for the Panky series, except that the surface layer is pale-brown loam about 4 inches thick. Permeability is slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth in this soil is 20 to 40 inches. Available water holding capacity is 4 to 5.5 inches.

The soils in this association are used for range, as wildlife habitat, and for water supply. Pojoaque soil: Dryland capability subclass VII<sub>e</sub>; River Breaks site; wildlife habitat group F. Panky soils: Dryland capability subclass VI<sub>e</sub>; Loamy range site; wildlife habitat group F.

**Pojoaque-Rough broken land complex** (9 to 25 percent slopes) (Pm) (PN).—This complex consists of about 50 percent Pojoaque sandy clay loam and 40 percent Rough broken land that is hilly. It was mapped at both high and low intensities. The major acreage, however, is in the low-intensity area. Included soils make up 10 percent of the mapped areas. These are Panky, Fivemile, and Bluewing soils in the low-intensity survey and Bluewing soils in the high-intensity survey. This complex is the major mapping unit within the survey area, and it is in the northern two-thirds of the survey area.

The Pojoaque soil has the profile described as representative for the Pojoaque series. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 8 to 9.5 inches.

Rough broken land is described under Rough broken land (RU) in this section.

This complex is used for range, community development, water supply, and wildlife habitat. Dryland capability subclass VII<sub>e</sub>; River Breaks range site; wildlife habitat group F.

## Prewitt Series

The Prewitt series consists of well-drained soils that formed in alluvium weathered from sandstone and shale. These soils are on terraces. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Galisteo and Moriarty series.

In a representative profile the surface layer is reddish-brown loam about 5 inches thick. The next layer is reddish-brown sandy clay loam about 10 inches thick. The

substratum is reddish-brown light sandy clay loam and clay loam to a depth of 60 inches or more. The soil material is calcareous and strongly alkaline.

Prewitt soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Prewitt loam, about 8 miles south of Lamy, in the unsectioned San Cristoval Grant,  $\frac{1}{4}$  mile east of U.S. Highway No. 285:

A1—0 to 5 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 4 to 8 inches thick.

AC—5 to 15 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine and medium tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 8 to 12 inches thick.

C1—15 to 35 inches, reddish-brown (5YR 4/3) light sandy clay loam, dark reddish brown (5YR 3/3) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; few very fine tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 15 to 25 inches thick.

C2—35 to 60 inches, reddish-brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) when moist; massive; hard, firm when moist, sticky and plastic when wet; very few very fine roots; very few very fine tubular pores; common lime mycelia; slightly calcareous; strongly alkaline (pH 8.6).

In the A and C horizons hue ranges from 2.5YR to 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. The texture between depths of 10 and 40 inches ranges from sandy clay loam to clay loam. Strata of sandy loam and silty clay loam are common below a depth of 40 inches. The content of salt in the C horizon ranges from none to moderate.

**Prewitt loam** (0 to 5 percent slopes) (PR).—This soil is level to moderately sloping. It is in the southern part of the survey area. Included in mapping were areas of Galisteo and Moriarty soils and areas of Alluvial land, saline.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is severe. Effective rooting depth is about 60 inches. Available water holding capacity is 7 to 8.5 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group E.

## Rednun Series

The Rednun series consists of well-drained soils that formed in old alluvium and mixed wind-laid material. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses and trees. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Bernal, Travessilla, Pena, and Hagerman series.

In a representative profile the surface layer is reddish-brown loam about 7 inches thick. The subsoil is dark-brown and brown heavy clay loam about 16 inches thick. The substratum is dark-brown clay loam and sandy clay loam to a depth of 60 inches or more. The soil material is moderately

to strongly alkaline. It is noncalcareous to a depth of 8 to 18 inches and calcareous below this depth.

Rednun soils are used for range, as wildlife habitat, and for water supply. The pinyon and juniper trees are a source of firewood and fenceposts.

Representative profile of Rednun loam, 1 to 9 percent slopes, 6 miles south of Ojo de La Vaca, SE  $\frac{1}{4}$  sec. 27, T. 13 N., R. 11 E.:

A1—0 to 7 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; very few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 9 inches thick.

B2t—7 to 15 inches, dark-brown (7.5YR 4/2) heavy clay loam, dark brown (7.5YR 3/2) when moist; strong, medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; few fine roots; few medium and fine tubular pores; thin patchy clay films; noncalcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 18 inches thick.

B3ca—15 to 23 inches, brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; few fine and very fine tubular pores; few, thin, patchy clay films; few threads and soft masses of calcium carbonate; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 12 inches thick.

C1ca—23 to 35 inches, dark-brown (7.5YR 4/4) clay loam, dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; very few very fine tubular pores; common threads and soft masses of calcium carbonate; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 10 to 18 inches thick.

C2—35 to 60 inches, dark-brown (7.5YR 4/4) very fine sandy clay loam, dark brown (7.5YR 4/2) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; common fine and very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4).

In the A horizon hue is 5YR or 7.5YR, and value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma is 2 or 3. The B2t horizon ranges from heavy clay loam to light clay. The upper 8 to 18 inches of these soils is free of lime. In the Cca horizon hue ranges from 7.5YR to 5YR, and value is 4 or 5 when dry and ranges from 2 to 4 when moist. Chroma ranges from 2 to 4. Sandstone is below a depth of 40 inches in places.

**Rednun loam, 1 to 9 percent slopes** (RD).—This soil is nearly level to moderately sloping. It is in the southern half of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Bernal, Travessilla, Galisteo, and Prewitt soils.

Permeability is slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 9.5 to 11 inches.

This soil is used for range, as wildlife habitat, and for water supply. Areas covered with pinyon and juniper are a source of firewood and fenceposts. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

**Rednun-Pena association, rolling** (RE).—This association consists of about 50 percent Rednun loam that has slopes of 1 to 9 percent and 30 percent Pena gravelly clay loam that has slopes of 1 to 25 percent. Included in map-

ping, and making up the other 20 percent of this association, are Clovis, Fivemile, and Panky soils and granite, sandstone, shale, and limestone outcroppings.

Permeability is slow in the Rednun soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 7.5 to 11 inches.

The Pena soil has a profile similar to that described as representative for the Pena series, except that the surface layer is dark-brown gravelly clay loam about 11 inches thick. Permeability is moderate in this soil. Runoff is slow to rapid, and the hazard of erosion is moderate to severe. Effective rooting depth in this soil is 12 to 30 inches or more to the strong lime zone. Available water holding capacity is 2 to 3.5 inches.

The soils in this association are used for range, as wildlife habitat, and for water supply. Areas covered with pinyon and juniper are a source of firewood and fenceposts. Rednun soil: Dryland capability subclass VIe; Loamy range site; wildlife habitat group F. Pena soil: Dryland capability subclass VIIe; Shallow range site; wildlife habitat group F.

**Rednun-Travessilla association, undulating (RG).**—This association consists of about 60 percent Rednun loam that has slopes of 1 to 5 percent and 30 percent Travessilla loam that has slopes of 5 to 9 percent. Included soils of the Bernal, Penistaja, and Galisteo series and sandstone outcrops make up the other 10 percent.

The Rednun soil has a profile similar to that described as representative for the Rednun series, except that bedrock is at a depth of 40 to 60 inches or more. Permeability is slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth in this Rednun soil is 40 to 60 inches. Available water holding capacity is 7.5 to 11 inches.

The Travessilla soil has the profile described as representative for the Travessilla series. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth in this soil is 6 to 18 inches. Available water holding capacity is 1 to 2 inches.

These soils are used for range, as wildlife habitat, and for water supply. Also, the Travessilla soils are a source of flagstone. Rednun soil: Dryland capability subclass VIe; Loamy range site; wildlife habitat group F. Travessilla soil: Dryland capability subclass VIIe; Shallow Sandstone range site; wildlife habitat group F.

## Riverwash

Riverwash (RH) is in channels of intermittent arroyos and live streams. The material in this land type is commonly sandy, and it is subject to shifting during periods of normal high water. Areas are essentially barren. Pockets of gravel, cobblestones, and stones are common in places. This land type is nearly level to gently sloping. It is mostly in the northern third of the survey area but is present throughout. This land type was mapped mostly at low intensity. Some areas, however, are intermingled with areas of soils mapped at high intensity. Elevation ranges from 6,000 to 7,500 feet.

Included with this land type in mapping were small areas of Bluewing soils that occur as islands scattered throughout the wider streambeds.

Areas of this land type are used for water supply and as a source of sand and gravel. Dryland capability subclass VIIw.

## Rock Outcrop

Rock outcrop (RK) consists of areas essentially devoid of soil and vegetation. It is mostly on tops of mountain peaks above the timberline and on the side walls of cirques. Areas of it are valuable because of their scenic beauty. This land type is nearly level to very steep. It is mostly in the northeastern part of the survey area. Elevation ranges from 7,500 to 12,500 feet.

Areas of this land type are used for water supply. Dryland capability subclass VIIIs.

**Rock outcrop-Chimayo complex, 45 to 100 percent slopes (RU).**—This complex consists of about 70 percent Rock outcrop and about 20 percent Chimayo stony sandy loam. Included soils and the land type Rock slides make up the other 10 percent. The soils are in the Mirabal and Supervisor series. This complex is in the northeastern part of the survey area and on the Ortiz Mountains in the southern part.

The Chimayo soil has a profile similar to that described as representative for the Chimayo series, except that the surface layer is stony sandy loam. Slopes are generally more than 60 percent. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 10 to 20 inches. Available water holding capacity is 1 to 2 inches.

The soils in this complex are used for range, as wildlife habitat, and for water supply. Pinyon and juniper are a source of firewood and fenceposts. Dryland capability subclass VIIIs; Mountain Shale range site; wildlife habitat group F.

## Rock Slides

Rock slides (RO) consist of loose rock material ranging from coarse gravel to boulders. This land type is steep to very steep. It is only at the higher elevations (9,000 to 12,500 feet) in the northeastern part of the survey area. The Rock slides are in the form of fans or aprons. They are made up of material deposited by snowslides, falling rock from cliffs, and material moved by glaciers. The rocks are moved by gravity when a down-cutting channel undermines their base. Stabilized slides commonly have scattered stands of spruce, but most Rock slides are barren.

Areas of this land type are used for water supply and to a limited extent have scenic value. Dryland capability subclass VIIIs.

## Rough Broken Land

Rough broken land (RU) consists of very steep, very shallow soils on ridges and mesas that are broken by intermittent drainage channels. The surface layer of this land type ranges from sandy loam to loam. The colluvium at the base of the escarpments and along the drainageways is deep. This land type is in the northern third of the survey area. Elevation ranges from 6,600 to 7,200 feet. Mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 50° F. The frost-free season is 160 to 170 days.

Geological erosion has been severe. Erosion by both wind and water is still active. Sandstone, siltstone, and some sandy shales outcrop are on the escarpments and mesa fronts. In places sandstone channers cap the lower lying hills. Runoff is very rapid. The hazard of erosion is severe.

Included with this land type in mapping were areas of Pojoaque, Fruitland, and Fivemile soils and a few areas of Badland.

Areas of this land type are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIIe; River Breaks range site; wildlife habitat group F.

## Santa Fe Series

The Santa Fe series consists of well-drained soils that formed in material weathered from granite, gneiss, and schist. These soils are on mountains. Depth to bedrock is 6 to 17 inches. Slopes are 5 to 25 percent. The vegetation is mostly midgrasses, shrubs, and trees. Elevation ranges from 6,600 to 7,200 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Chimayo, Panky, and La Fonda series.

In a representative profile the surface layer is dark grayish-brown gravelly clay loam about 3 inches thick. The subsoil is dark-brown very gravelly clay loam about 10 inches thick. It is underlain by granite at a depth of about 13 inches. Reaction of the soil material is neutral.

Santa Fe soils are used for range, as wildlife habitat, and for water supply. Areas of this soil near the city of Santa Fe are used for community development.

Representative profile of Santa Fe gravelly clay loam in an area of Santa Fe-Rock outcrop complex, 5 to 25 percent slopes, 5 miles south of the city limits of Santa Fe, 1 mile west of U.S. Highway Nos. 84, 85, and 285, SE $\frac{1}{4}$  sec. 30, T. 16 N., R. 10 E.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and nonplastic when wet; many fine roots; common fine interstitial pores; 15 percent granitic gravel; neutral (pH 7.0); clear boundary. 2 to 5 inches thick.

B2t—3 to 13 inches, dark-brown (7.5YR 4/2) very gravelly clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable when moist, sticky and plastic when wet; many fine roots; common fine interstitial pores; thin patchy clay films; 50 percent granitic gravel; neutral (pH 7.0); clear boundary. 4 to 12 inches thick.

R—13 inches, thick fractured granite; some soil material in fractures.

In the A horizon value is 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 7.5YR or 5YR, and value is 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. The B2t horizon ranges from very gravelly clay loam to very gravelly loam. Depth to the underlying granitic rock ranges from 6 to 17 inches.

**Santa Fe-La Fonda association, hilly (SF).**—This association consists of about 45 percent Santa Fe clay loam that has slopes of 9 to 25 percent, and 45 percent La Fonda loam that has slopes of 5 to 9 percent. Included Chimayo soils and rock outcroppings make up the other 10 percent.

The Santa Fe soil has a profile similar to that described as representative for the Santa Fe series. The surface layer

of the Santa Fe soil is clay loam, however, and the depth to granite is about 8 inches. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth in this Santa Fe soil is 6 to 17 inches. Available water holding capacity is 1 to 2 inches.

The La Fonda soil has the profile described as representative for the La Fonda series. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth in this soil is about 60 inches. Available water holding capacity is 7.5 to 9.0 inches.

The soils in this association are used for range, as wildlife habitat, and for water supply and community development. Santa Fe soil: Dryland capability subclass VIIe; Hills range site; wildlife habitat group F. La Fonda soil: Dryland capability subclass VIe; Loamy range site; wildlife habitat group F.

**Santa Fe-Rock outcrop complex, 5 to 25 percent slopes (Sk) (SM).**—This complex consists of about 65 percent Santa Fe gravelly clay loam and 25 percent Rock outcrop. The Santa Fe soils are moderately sloping to moderately steep. Rock outcrop is intermingled throughout the areas of Santa Fe soils in a definite or repeating pattern. Included soils make up the other 10 percent of this complex. These are Chimayo and Panky soils in the low-intensity survey and Chimayo soils in the high-intensity survey. This complex is in the central part of the survey area. It is in both the high- and low-intensity areas, but the major part is in the low-intensity area.

The Santa Fe soil has the profile described as representative for the Santa Fe series. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth is 6 to 17 inches. Available water holding capacity is 1 to 2 inches.

The soils in this complex are used for range, as wildlife habitat, and for water supply. Areas of this complex near the city of Santa Fe are used for community development. Dryland capability subclass VIIe; Hills range site; wildlife habitat group F.

## Silver Series

The Silver series consists of well-drained soils that formed in material weathered from basalt and wind-laid deposits of volcanic debris. These soils are on alluvial fans. Slopes are 0 to 10 percent. The vegetation is mostly midgrasses and pinyon and juniper. Elevation ranges from 6,600 to 7,000 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 160 to 170 days. Associated soils are in the Calabasas, Apache, and Majada series.

In a representative profile the surface layer is brown loam about 3 inches thick. The subsoil is brown clay to a depth of about 14 inches. Below this, it is light-brown silty clay loam that extends to a depth of about 45 inches. The substratum is pinkish-gray very fine sandy loam to a depth of 60 inches or more. The soil material is noncalcareous to a depth of 10 to 23 inches. It is mildly alkaline or moderately alkaline.

Silver soils are used for range, as wildlife habitat, and for water supply. In some areas of this soil pinyon and juniper are a source of firewood and fenceposts.

Representative profile of Silver loam, 0 to 10 percent



slopes, in the Caja del Rio Grant, about 2 miles northeast of Tetilla Peak, NE $\frac{1}{4}$  sec. 9, T. 16 N., R. 7 E.:

- A1—0 to 3 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, thick, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine vesicular pores; noncalcareous; mildly alkaline (pH 7.4); clear boundary. 3 to 9 inches thick.
- B21t—3 to 14 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure and strong, medium, subangular blocky; very hard, very firm when moist, very sticky and very plastic when wet; common fine and very fine roots; few fine tubular pores; many moderately thick clay films; noncalcareous; mildly alkaline (pH 7.8); clear boundary. 7 to 14 inches thick.
- B22t—14 to 30 inches, light-brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) when moist; moderate, medium, subangular blocky structure; very hard, firm when moist, slightly sticky and slightly plastic when wet; few fine and medium roots; few fine tubular pores; few thin clay films; common, medium, prominent nodules of lime; strongly calcareous; moderately alkaline (pH 8.4); clear boundary. 12 to 20 inches thick.
- B3ca—30 to 45 inches, light-brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and nonplastic when wet; few fine roots; few fine tubular pores; many, medium, prominent nodules of lime and mycelia; strongly calcareous; moderately alkaline (pH 8.4); abrupt boundary. 10 to 20 inches thick.
- Cca—45 to 60 inches, pinkish-gray (7.5YR 7/2) very fine sandy loam, pinkish gray (7.5YR 6/2) when moist; massive; very hard, friable when moist, nonsticky and nonplastic when wet; very few very fine roots; few fine tubular pores; almost continuous, medium, prominent lime nodules and blotches; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 5YR or 7.5YR, and value is 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. The B21t horizon ranges from heavy clay loam to light clay. In the B3ca horizon color range is the same as in the B2t horizon. Texture of the B3ca is clay loam or silty clay loam. In the Cca horizon hue is 5YR or 7.5YR, and value ranges from 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. Buried soils of heavy clay loam are common below a depth of 30 inches. Most horizons are less than 5 percent gravel, but some are as much as 15 percent.

**Silver-Pojoaque association, undulating (SP).**—This association consists of about 50 percent Silver loam that has slopes of 1 to 5 percent and 30 percent Pojoaque clay loam that has slopes of 5 to 9 percent. Included soils make up the other 20 percent. These are Panky, Fivemile, Harvey, and Cerrillos soils.

Permeability is slow in the Silver soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth in this soil is about 60 inches. Available water holding capacity is 10 to 11.5 inches.

The Pojoaque soil has a profile similar to that described as representative for the Pojoaque series, except that the surface layer is clay loam. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth in this soil is about 60 inches. Available water holding capacity is 8 to 9.5 inches.

The soils in this association are used for range, as wildlife habitat, and for water supply. Silver soil: Dryland capability subclass VIe; Loamy range site; wildlife habitat group F. Pojoaque soil: Dryland capability subclass VIIe; River Breaks range site; wildlife habitat group F.

**Silver loam, 0 to 10 percent slopes (SR).**—This soil is level to strongly sloping. It is in the north-central part of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Calabasas, Harvey, and Panky soils.

Permeability is slow in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is about 60 inches. Available water holding capacity is 10 to 11.5 inches.

This soil is used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Loamy range site; wildlife habitat group B.

## Stony Rock Land

Stony rock land (20 to 100 percent slopes) (ST) consists of areas where 30 to 90 percent of the surface is covered with cobblestones and stones. About 20 percent of this land type is sandstone, limestone, and granite outcroppings. This land type is steep to very steep. It is mostly in the southwestern part of the survey area. Elevation ranges from 6,000 to 8,000 feet.

Included with this land type in mapping were pockets of deeper soils, mostly at the higher elevations.

Areas of this land type are used as wildlife habitat and for range and water supply. Dryland capability subclass VIIi; Hills range site; wildlife habitat group F.

## Supervisor Series

The Supervisor series consists of well-drained soils that formed in material weathered from granite, gneiss, and schist. Depth to bedrock is 20 to 30 inches. Slopes are 15 to 100 percent. The vegetation is mostly conifers and scattered bunches of midgrasses. Elevation ranges from 8,500 to 9,500 feet. The mean annual precipitation is 20 to 24 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 50 to 90 days. Associated soils are in the Bobtail, Nambe, and Zuni variant series.

In a representative profile the surface layer is dark-gray and dark grayish-brown gravelly sandy loam about 10 inches thick. The substratum is pale-brown very gravelly light sandy loam underlain by bedrock at a depth of about 23 inches. The soil material is slightly acid.

Supervisor soils are used as timberland and wildlife habitat and for water supply and recreation.

Representative profile of Supervisor gravelly sandy loam, 15 to 60 percent slopes, about 2 miles northwest of the Santa Fe Ski Basin, SW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 1, T. 18 N., R. 10 E.:

- O1 & O2—3 inches to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.
- A11—0 to 2 inches, dark-gray (10YR 4/1) gravelly sandy loam, very dark gray (10YR 3/1) when moist; strong, fine, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine interstitial pores; about 15 percent fine gravel; noncalcareous; slightly acid (pH 6.2); abrupt boundary. 2 to 4 inches thick.
- A12—2 to 10 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, crumb structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and medium roots; common fine interstitial pores; about 20 percent gravel and 10 percent cobblestones and stones; noncalcareous; slightly acid (pH 6.2); gradual boundary, 6 to 10 inches thick.



C—10 to 23 inches, pale-brown (10YR 6/3) very gravelly light sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable when moist, non-sticky and nonplastic when wet; few fine roots; few fine and medium interstitial pores; about 40 percent gravel and 10 percent cobbles and stones; non-calcareous; slightly acid (pH 6.2); clear boundary. 5 to 16 inches thick.

R—23 inches, partly weathered granite, gneiss, and schist.

In the A horizon value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 1 or 2. In the C horizon hue is 7.5YR or 10YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma is 2 or 3. The C horizon ranges from fine sandy loam to light sandy loam. The content of coarse fragments ranges from 20 to 50 percent but averages more than 35 percent. Depth to the R horizon ranges from 20 to 30 inches.

**Supervisor gravelly sandy loam, 15 to 60 percent slopes (SU).**—This soil is moderately steep to very steep. It is in the northeastern part of the survey area. This soil has the profile described as representative for the series. Included in mapping were areas of Mirabal and Cundiyo soils and a few scattered areas of Rock slides and Rock outcrop.

Permeability is moderately rapid in this soil. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is about 25 inches. Available water holding capacity is .5 to 1.5 inches.

This soil is used as timberland and wildlife habitat and for water supply and recreation. Dryland capability subclass VIIe; timber suitability groups 2 and 5; wildlife habitat group G.

**Supervisor-Rock outcrop complex, 45 to 100 percent slopes (SV).**—This complex consists of about 65 percent Supervisor gravelly sandy loam and 25 percent Rock outcrop. The Supervisor soils are steep to very steep and are intermingled throughout the Rock outcrop in a definite or repeating pattern. Included soils make up the other 10 percent. These are Cundiyo and Mirabal soils.

Permeability is moderately rapid in the Supervisor soils. Runoff is rapid, and the hazard of erosion is severe. Effective rooting depth is 20 to 30 inches. Available water holding capacity is .5 to 1.5 inches.

This complex is used as timberland and wildlife habitat and for water supply and recreation. Dryland capability subclass VIIe; timber suitability groups 3 and 6; wildlife habitat group G.

## Tapia Series

The Tapia series consists of well-drained soils that formed in old alluvium of mixed origin. These soils are on ridges. Slopes are 1 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Dean, Harvey, Pastura, and Clovis series.

In a representative profile the surface layer is a brown loam about 4 inches thick. The subsoil is reddish-brown and light-brown clay loam about 17 inches thick. The substratum, to a depth of 60 inches or more, is pink gravelly loam that has a high content of lime. The soil material is noncalcareous to a depth of 8 to 18 inches. It is moderately alkaline to strongly alkaline.

Tapia soils are used for range, as wildlife habitat, and for water supply.

Representative profile of Tapia loam in an area of Tapia-Dean loams, 1 to 5 percent slopes, 1 mile north of the Torrance County line and 10 miles south of White Lakes, 340 feet north of fence, SW $\frac{1}{4}$  sec. 28, T. 10 N., R. 11 E.:

A1—0 to 4 inches, brown (7.5YR 5/4) loam, dark-brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine and medium tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 2 to 6 inches thick.

B21t—4 to 12 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few medium and fine tubular pores; thin patchy clay films; noncalcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 12 inches thick.

B22tca—12 to 16 inches, light-brown (7.5YR 6/4) clay loam, reddish brown (5YR 5/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine and very fine roots; few fine tubular pores; few, thin, patchy clay films; strongly calcareous; strongly alkaline (pH 8.6); clear boundary. 3 to 6 inches thick.

B3ca—16 to 21 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; weak, fine, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common medium and fine tubular pores; 5 to 10 percent indurated caliche gravel; disseminations of lime; strongly calcareous; strongly alkaline (pH 8.6); abrupt boundary. 3 to 8 inches thick.

Cca—21 to 60 inches, pink (7.5YR 8/4) gravelly loam, light brown (7.5YR 6/4) when moist; massive; very hard, firm when moist; slightly sticky and slightly plastic when wet; no roots; many medium and fine interstitial pores; 20 percent indurated caliche gravel and 30 percent cobbles weakly to strongly cemented together, less strongly cemented below a depth of 35 inches; strongly calcareous; strongly alkaline (pH 8.8).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR or 5YR, and value ranges from 4 to 6 when dry and 3 to 5 when moist. Chroma ranges from 2 to 4. The B2t horizon ranges from heavy loam to clay loam. The lower part of the B2t horizon ranges from noncalcareous to moderately calcareous. In the Cca horizon hue is 7.5YR or 5YR, and value ranges from 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4.

**Tapia-Dean loams, 1 to 5 percent slopes (TA).**—This complex consists of about 50 percent Tapia loam and 30 percent Dean loam intermingled in a definite or repeating pattern. These soils are nearly level to gently sloping. This complex is in the southern part of the survey area. Included soils make up the other 20 percent. These are Harvey, Pastura, and Clovis soils.

Permeability is moderate in the Tapia soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 16 to 32 inches. Available water holding capacity is 3.5 to 5 inches.

Permeability is slow in the Dean soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 6 to 16 inches. Available water holding capacity is 1.5 to 3 inches.

These soils are used for range, as wildlife habitat, and for water supply. Dryland capability subclass VIe; Tapia soil in Loamy range site, Dean soil in Shallow range site; both soils in wildlife habitat group A.

## Travessilla Series

The Travessilla series consists of well-drained soils that formed in material weathered from sandstone. Depth to sandstone is 6 to 18 inches. Slopes are 1 to 25 percent. The vegetation is mostly mid grasses and pinyon and juniper. Elevation ranges from 6,400 to 6,800 feet. The mean annual precipitation is 12 to 15 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 150 to 160 days. Associated soils are in the Bernal, Hagerman, Rednun, and Prewitt series.

In a representative profile the surface layer is reddish-brown loam underlain by sandstone at a depth of about 10 inches. The soil material is calcareous and mildly alkaline.

Travessilla soils are used for range, as wildlife habitat, and for water supply. Flagstone is mined in places, and pinyon and juniper are a source of firewood and fenceposts.

Representative profile of Travessilla loam in an area of Rednun-Travessilla association, undulating, 8 miles south and 1 mile east of Galisteo, in the unsectioned San Cristoval Grant, 1 mile east of State Route No. 41:

A1—0 to 10 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; loose, very friable when moist, non-sticky and nonplastic when wet; common fine and very fine roots; few fine tubular pores; slightly calcareous; mildly alkaline (pH 7.8); abrupt boundary. 6 to 18 inches thick.

R—10 inches, reddish sandstone.

In the A horizon hue ranges from 5YR to 10YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. It ranges from fine sandy loam to loam and is 0 to 15 percent stones or channers.

**Travessilla-Bernal fine sandy loams** (1 to 9 percent slopes) (TB).—This complex consists of about 50 percent Travessilla fine sandy loam and 30 percent Bernal fine sandy loam. The Travessilla soil is moderately sloping. The Bernal soil is nearly level to gently sloping. Included Hagerman and Penistaja soils and sandstone and shale outcrops make up the other 20 percent of this complex.

The Travessilla soil has a profile similar to that described as representative for the Travessilla series, except that the surface layer is fine sandy loam. Permeability is moderate in this soil. Runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth is 6 to 18 inches. Available water holding capacity is 1 to 1.5 inches.

The Bernal soil in the Santa Fe survey area is mapped only as a member of this complex. It is present throughout the survey area but is most extensive in the southern half. Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 12 to 20 inches. Available water holding capacity is 2.5 to 3.5 inches.

The soils in this complex are used for range, as wildlife habitat, for water supply, and as a source of flagstone. Dryland capability subclass VII<sub>s</sub>; Travessilla soil in Shallow sandstone range site; Bernal soil in Loamy range site; both soils in wildlife habitat group F.

**Travessilla-Rock outcrop complex, 1 to 25 percent slopes** (TR).—This complex consists of about 50 percent Travessilla fine sandy loam and 25 percent Rock outcrop. The Travessilla soils are nearly level to moderately steep and are intermingled with the Rock outcrop in a definite or repeating pattern. Included Bernal, Rednun, Moriarty,

and Prewitt soils and shale and gypsum outcrops make up the other 25 percent of this complex.

Permeability is moderate in the Travessilla soil. Runoff is rapid, and the hazard of erosion is moderate to severe. Effective rooting depth is 6 to 18 inches. Available water holding capacity is 1 to 1.5 inches.

This complex is used for range, as wildlife habitat, and for water supply. The Rock outcrop is a source of flagstone. Dryland capability subclass VII<sub>s</sub>; Shallow Sandstone range site; wildlife habitat group F.

## Tuff Rock Land

Tuff rock land (TU) consists of exposed areas of welded tuff and pumice and, in places, extremely stony talus slopes. The tuff and pumice are along very steep canyon walls. This land type is very steep. It is only in the extreme northwestern part of the survey area. Elevation ranges from 6,400 to 8,000 feet.

Included with this land type in mapping were areas of Guaje soils and a small acreage of unclassified soils that are moderately deep.

Erosion is a serious concern of management. This land type is too steep to use for domestic livestock. Wildlife use it for escape and as a source of food. The very steep cliff-like areas have scenic value. This land type provides large amounts of water during heavy storms. Dryland capability subclass VIII<sub>s</sub>; wildlife habitat group F.

## Wilcoxson Series, Soft Bedrock Variant

The Wilcoxson series, soft bedrock variant, consists of well-drained soils that formed in material weathered from granite and schist. Depth to soft bedrock is 30 to 36 inches. Slopes are 15 to 40 percent. The vegetation is mostly ponderosa pine, mixed conifer, mid grasses, and shrubs. Elevation ranges from 7,800 to 9,200 feet. The mean annual precipitation is 16 to 18 inches, and the mean annual air temperature is 43° to 45° F. The frost-free season is 60 to 100 days. Associated soils include the Zuni variant, Fortwingate variant, and McVickers variant.

In a representative profile the surface layer is brown sandy clay loam about 2 inches thick. The subsoil is about 24 inches thick. The upper 5 inches is dark-brown sandy clay, and the lower 19 inches is reddish-brown clay and light reddish-brown gravelly clay. The substratum is reddish-brown coarse sandy loam about 5 inches thick. Bedrock is at a depth of about 31 inches. The soil material is slightly acid to neutral in reaction.

These soils are used as timberland and wildlife habitat and for water supply.

Representative profile of Wilcoxson sandy clay loam, soft bedrock variant, 15 to 40 percent slopes, about 5 miles northeast of Cundiyo, SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 6, T. 20 N., R. 11 E.:

O1 & O2—1 inch to 0, litter layer of undecomposed and partly decomposed needles, twigs, leaves, and bark.

A1—0 to 2 inches, brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 3/2) when moist; moderate, thick, platy structure and weak, fine, granular; soft, friable when moist, nonsticky and nonplastic when wet; many fine and medium roots; many medium vesicular pores; slightly acid (pH 6.4); abrupt boundary. 2 to 4 inches thick.

B1—2 to 7 inches, dark-brown (7.5YR 4/2) sandy clay, dark brown (7.5YR 3/2) when moist; moderate, fine and medium, angular blocky structure; extremely hard,

- firm when moist, sticky and plastic when wet; many fine and medium roots; common fine tubular pores; neutral (pH 6.6); clear boundary. 4 to 6 inches thick.
- B21t—7 to 20 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; strong, medium and coarse, angular blocky structure; extremely hard, very firm when moist, very sticky and very plastic when wet; common medium roots; common fine tubular pores; thin clay films on ped surfaces; neutral (pH 6.8); clear boundary. 10 to 15 inches thick.
- B22t—20 to 26 inches, light reddish-brown (5YR 6/4) gravelly clay, reddish brown (5YR 5/4) when moist; very weak, medium and coarse, angular blocky structure; extremely hard, very firm when moist, sticky and plastic when wet; few medium roots; common fine tubular pores; thin clay films on ped surfaces; neutral (pH 7.2); clear boundary. 4 to 8 inches thick.
- C1ca—26 to 31 inches, reddish-brown (5YR 5/4) coarse sandy loam, reddish brown (5YR 4/4) when moist; massive; soft, very friable when moist; nonsticky and nonplastic when wet; very few fine roots; common fine interstitial pores; few calcium carbonate patches and fillings in cracks; calcareous; neutral (pH 7.2); clear boundary. 4 to 8 inches thick.
- C2—31 inches, reddish-brown (5YR 4/4), soft weathered granite and schist.

In the A1 and B1 horizons value is 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 5YR or 2.5YR, and value ranges from 4 to 6 when dry and 3 to 5 when moist. Chroma is 3 or 4. In places calcium carbonate is present in the lower part of the B horizon or upper part of the C horizon.

**Wilcoxson sandy clay loam, soft bedrock variant, 15 to 40 percent slopes (WC).**—This soil is moderately steep to steep. It is in the northeastern part of the survey area. Included in mapping were areas of Borrego and Mirabal soils.

Permeability is slow in this soil, Runoff is medium to rapid, and the hazard of erosion is severe. Effective rooting depth is 30 to 36 inches. Available water holding capacity is 3.5 to 5 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 2 and 5; wildlife habitat group H.

## Willard Series

The Willard series consists of well-drained soils that formed in lake-laid sediment and recent alluvium on old lake benches. Slopes are 0 to 3 percent. The vegetation is mostly mid grasses and forbs. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the La Brier, Moriarty, and Penistaja series.

In a representative profile the surface layer is brown loam about 10 inches thick. The substratum, to a depth of about 19 inches, is pink light clay loam. Below this, the substratum, to a depth of 60 inches or more, is very pale brown light clay loam that has a high content of lime, gypsum, and other salts. The soil material is moderately alkaline to strongly alkaline.

Willard soils are used for range, as wildlife habitat, and for water supply. A few areas are in irrigated crops.

Representative profile of Willard loam, 1 mile south and 2 miles east of Otto, NE1/4 sec. 34, T. 10 N., R. 9 E.:

- A1—0 to 3 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft,

very friable when moist; nonsticky and nonplastic when wet; many fine and very fine roots; few very fine tubular pores; noncalcareous; moderately alkaline (pH 8.4); clear boundary. 2 to 6 inches thick.

- A12—3 to 10 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine and very fine roots; few fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4); clear boundary. 6 to 9 inches thick.

- C1ca—10 to 19 inches, pink (7.5YR 7/4) light clay loam, brown (7.5YR 5/4) when moist; weak, fine, subangular blocky structure and weak, fine, granular; slightly hard, friable when moist; slightly sticky and slightly plastic when wet; few fine and very fine roots; few fine and medium tubular pores; slightly calcareous; strongly alkaline (pH 8.6); clear boundary. 8 to 12 inches thick.

- C2ca—19 to 60 inches, very pale brown (10YR 7/4) light clay loam, light yellowish brown (10YR 6/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; very few very fine roots; very few very fine tubular pores; lacustrine sediment high in carbonates, gypsum, and other salts; slightly calcareous; strongly alkaline (pH 8.8); many feet thick.

In the A horizon value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. In the Cca horizon hue ranges from 7.5YR to 2.5Y, and value ranges from 6 to 8 when dry and is 5 or 6 when moist. Chroma ranges from 2 to 4. The Cca horizon is loam or light clay loam. Depth to lacustrine sediment ranges from 15 to 30 inches.

**Willard loam (0 to 3 percent slopes) (WL).**—This soil is level to nearly level. It is in the extreme southern part of the survey area. Included in mapping were small areas of La Brier, Moriarty, and Penistaja soils.

Permeability is moderately slow in this soil. Runoff is slow, and the hazard of erosion is moderate. Effective rooting depth is 20 to 48 inches. Available water holding capacity is 3.75 to 5 inches.

This soil is used for range, irrigated crops, water supply, wildlife habitat. Irrigated capability unit IIIs-1; Dryland capability subclass VIe; Loamy range site; wildlife habitat group E.

## Witt Series

The Witt series consists of well-drained soils that formed in old mixed alluvium on alluvial fans. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses. Elevation ranges from 6,200 to 6,600 feet. The mean annual precipitation is 12 to 14 inches, and the mean annual air temperature is 48° to 52° F. The frost-free season is 130 to 140 days. Associated soils are in the Harvey, Clovis, and La Brier series.

In a representative profile the surface layer is brown loam about 8 inches thick. The subsoil is about 28 inches thick. The upper 15 inches is reddish-brown clay loam, and the lower 13 inches is yellowish-red sandy clay loam. The substratum, to a depth of 60 inches or more, is pinkish-white loam that has a very high content of lime. The soil material is moderately alkaline to strongly alkaline. It is noncalcareous to a depth of 18 to 29 inches and calcareous below this depth.

Witt soils are used for range, irrigated crops, water supply, and wildlife habitat.

Representative profile of Witt loam, 1/2 mile north and 1/2 mile east of Edgewood, along road near the south quarter corner of sec. 23, T. 11 N., R. 7 E.:

A1—0 to 8 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, very fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few very fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 8 inches thick.

B21t—8 to 14 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few very fine tubular pores; thick continuous clay films; noncalcareous; moderately alkaline (pH 8.0); clear boundary. 5 to 9 inches thick.

B22t—14 to 23 inches, reddish-brown (5YR 4/4) clay loam, reddish brown (5YR 4/3) when moist; weak, coarse, prismatic structure and moderate, medium subangular blocky; hard, firm when moist, sticky and plastic when wet; few very fine roots; few fine tubular pores; thick continuous clay films; noncalcareous; moderately alkaline (pH 8.2); clear boundary. 8 to 12 inches thick.

B23tca—23 to 28 inches, yellowish-red (5YR 4/6) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few very fine tubular pores; few, thin, discontinuous clay films on peds; disseminations of calcium carbonate and a few lime nodules; strongly calcareous; moderately alkaline (pH 8.2); clear boundary. 4 to 10 inches thick.

B3ca—28 to 36 inches, yellowish-red (5YR 4/6) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure; hard, friable when moist, slightly sticky and slightly plastic when wet; very few, very fine roots; few fine tubular pores; very few, thin, discontinuous clay films, lime segregated in soft masses; strongly calcareous; moderately alkaline (pH 8.4); abrupt boundary. 8 to 16 inches thick.

Cca—36 to 60 inches, pinkish-white (5YR 8/2) loam, pink (5YR 7/4) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine tubular pores; 20 to 40 percent disseminations of calcium carbonate; strongly calcareous; strongly alkaline (pH 8.6).

In the A horizon value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. In the B2t horizon hue is 7.5YR or 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. The B2t horizon ranges from heavy loam to clay loam or silty clay loam. In the Cca horizon hue is 7.5YR or 5YR, and value ranges from 6 to 8 when dry and 5 to 7 when moist. Chroma ranges from 2 to 4. Buried soils of clay loam are common below a depth of 48 inches.

**Witt loam** (0 to 5 percent slopes) (WN).—This soil is level to gently sloping. It is in the southern part of the survey area. Included in mapping were areas of Clovis, Harvey, and La Brier soils.

Permeability is moderate in this soil. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 36 to 48 inches. Available water holding capacity is 6 to 8 inches.

This soil is used for range, irrigated crops, water supply, and wildlife habitat.

This soil was once the most extensively dryfarmed soil in the survey area, but it is now in grass, except for a few hundred acres in small grain. It is dryfarmed only in an area around the San Pedro Mountains where the rainfall is somewhat higher. In Torrance County, bordering to the south, this soil receives more precipitation and is in Dryland capability class IV. Irrigated capability unit IIe-1; dryland capability subclass VIe; Loamy range site; wildlife habitat group E.

## Zuni Series, Brown Subsoil Variant

The Zuni series, brown subsoil variant, consists of well-drained soils that formed in material weathered from granite, gneiss, and schist. It is on mountainous uplands. Depth to bedrock is 20 to 40 inches. Slopes are 10 to 40 percent. The vegetation is mostly mixed conifers, forbs, and mid grasses. Elevation ranges from 8,400 to 9,200 feet. The mean annual precipitation is 20 to 24 inches, and the mean annual air temperature is 43° to 45° F. The frost-free season is 60 to 100 days. Associated soils are in the Supervisor, Borrego, Wilcoxson variant, and Cundiyo series.

In a representative profile the surface layer is dark grayish-brown loam about 3 inches thick. The subsurface layer is grayish-brown and brown loam about 8 inches thick. The subsoil is dark-brown and brown light clay loam and clay about 9 inches thick. Partly weathered schist is at a depth of about 20 inches, and schist bedrock is at a depth of 36 inches. The soil material is slightly acid to neutral in reaction.

Zuni variant soils are used as timberland and wildlife habitat and for water supply.

Representative profile of Zuni loam, brown subsoil variant, 10 to 40 percent slopes, 7 miles northeast of Cundiyo, 1/4 mile south of the Rio Arriba County line, NW 1/4 NW 1/4 sec. 3, T. 20 N., R. 11 E.:

O1 & O2—2 inches to 0, litter layer of undecomposed and partly decomposed needles, leaves, twigs, and bark.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, fine, crumb structure; slightly hard, friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine interstitial pores; slightly acid (pH 6.4); abrupt boundary. 2 to 4 inches thick.

A2—3 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, nonsticky and nonplastic when wet; many fine and medium roots; many fine tubular pores; slightly acid (pH 6.4); gradual boundary. 2 to 4 inches thick.

A&B—6 to 11 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; hard, firm when moist, slightly sticky and slightly plastic when wet; common medium roots; common fine and medium tubular pores; neutral (pH 6.6); clear boundary. 4 to 6 inches thick.

B1—11 to 16 inches, dark-brown (10YR 4/3) light clay loam, dark brown (10YR 3/3) when moist; moderate, fine, angular blocky structure; extremely hard, very firm when moist, sticky and plastic when wet; few medium and coarse roots; few medium tubular pores; neutral (pH 6.6); clear boundary. 4 to 7 inches thick.

B2t—16 to 20 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; strong, medium, angular blocky structure; extremely hard, very firm when moist, very sticky and very plastic when wet; few coarse roots; few medium tubular pores; thin clay films; neutral (pH 6.8); clear boundary. 3 to 6 inches thick.

C—20 to 36 inches, weathered schist. 5 to 20 inches thick.  
R—36 inches, schist bedrock.

In the A1 horizon value is 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the A2 horizon hue is 10YR or 7.5YR, and value is 4 to 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. In the B2t horizon hue is 10YR or 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. The B2t horizon ranges from heavy clay loam to clay. Variegated colors are common in the B2t horizon. Depth to the R horizon ranges from 20 to 40 inches.

**Zuni loam, brown subsoil variant, 10 to 40 percent slopes (ZU).**—This soil is strongly sloping to steep. It is in the northeastern part of the survey area. Included in mapping were areas of Supervisor, Borrego, Wilcoxson variant, Cundiyo soils, and small areas of soils that are similar to Zuni loam but are more than 40 inches deep.

Permeability is slow in this soil. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Effective rooting depth is 20 to 40 inches. Available water holding capacity is 3.5 to 4.5 inches.

This soil is used as timberland and wildlife habitat and for water supply. Dryland capability subclass VIIe; timber suitability groups 1 and 4; wildlife habitat group G.

## Use and Management of the Soils

Use and management of the soils for range is presented in the first part of this section. Range sites and condition classes are described and discussed in this part, and soils that have similar characteristics are assigned to the same site. Following this is a discussion of the use and management of soils for crops. Here the soils are grouped according to limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment.

Next in the section is a discussion of the use of soils as timberland and a placing of the soils in "timber suitability groups." Use and management of the soils for wildlife habitat are then discussed. Here again the soils are grouped according to their suitability, and a description of each group is presented. Characteristics of the soil that influence use, kinds and patterns of vegetation, and suitability for local wildlife are given in each description.

The subsection titled "Engineering Uses of the Soils," near the end of this section, presents information of special interest to engineers, contractors, farmers, and others who use soil as structural or foundation material. Following this, at the end of the section, recreational uses of the soils are discussed.

## Use of the Soils for Range <sup>2</sup>

The current use of grassland in the Santa Fe Area, the range sites, the range condition classes, and descriptions of the range sites are presented in this subsection.

Almost four-fifths of the Santa Fe survey area is rangeland and small pastures. About 75 percent of this is used throughout the year, mostly by cattle.

Federal, State, private, and Pueblo Indian lands are intermingled throughout the Area. Owing in part to this status of the land, various types of livestock operations are carried on. In the southern fourth of the survey area is mainly a cow-calf operation in which 2 or 3 operators utilize corn silage and other irrigated crops. In the central part, where the ranches are the largest, is either a cow-calf or steer operation. Summer-use areas are mainly at higher elevation or are small areas in the extreme northwest corner of the survey area. At the higher elevations is federally owned land under the jurisdiction of the Forest Service. This summer-use land is used by holders of permits.

## Range sites and condition classes

The productive capacity of different areas of range depends primarily on the combined effects of the soils and the climate peculiar to the area. The concept of the range site expresses these differences in terms of productive capacity.

A range site is a distinctive kind of rangeland that differs from other kinds in its potential to produce native plants. It is the product of all environmental factors responsible for its formation. A range site supports vegetation characterized by an association of species different from that of other range sites in terms of kind or proportion of species or total annual yield. Abnormal disturbance and physical site deterioration are assumed to be absent for such support to take place.

Range condition is the present state of vegetation of a range site in relation to the potential vegetation for that site. Range condition classes are an expression of the degree to which the present plant composition, in percent, has departed from that of the potential plant community of a range site. Four range condition classes are recognized, each representing a degree of deterioration of the plant cover. A site is in excellent condition if 76 to 100 percent of the stand is of the same composition as the potential stand. It is in good condition if the percentage is between 51 and 75, in fair condition if the percentage is between 26 and 50, and in poor condition if the percentage is 25 or less.

In comparing the present vegetation with the potential vegetation for a site, the components of the vegetation are classified in three broad categories according to their response to grazing. These categories are identified as decreasers, increasers, and invaders.

Decreasers are species present in the potential plant community that decrease in relative abundance when such a community is subject to continued excessive grazing. Generally, the decrease from excessive grazing results from a high, specific, animal preference for the species during the season of use.

Increasers, on the other hand, are species present in the potential plant community that generally increase in relative abundance when the vegetation is subject to continued excessive grazing. Not all increasers, however, respond in this simple fashion. Some plants of moderately high grazing preference first increase and then decrease if grazing pressure continues.

Invader plants, of low grazing preference or negligible grazing value, are plants which increase either in relative composition or in actual plant numbers. They are not present originally in the potential plant community for the site but invade the site as a result of various kinds of disturbance. They are not restricted to exotics, however, as they may be normal components of the potential vegetation on other range sites in the same general area. They may be woody or herbaceous or annuals or perennials. Their forage value and relative grazing preference may be high or low.

## Descriptions of range sites

The soils of the Santa Fe Area have been grouped into the range sites described in the following paragraphs. The description of each range site gives the important soil characteristics, qualities, principal plants, productivity, and information about range-improvement practices.

<sup>2</sup> By DANIEL L. MERKEL, range conservationist, Soil Conservation Service.

The soil series represented are named in the description of each range site, but this does not necessarily mean that all the soils in a given series are in the same site. To find the range site for any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

Badland, Basalt rock land, Rock outcrop, Rock slides, Tuff rock land, and Riverwash are not included in the range sites, because they are not suited to use as range-land. Irrigated soils managed primarily as irrigated cropland and tame pasture and timber soils managed primarily as timberland are not placed in range sites.

#### ALPINE SLOPES RANGE SITE

Penitente cobbly loam, 0 to 30 percent slopes, is the only soil in this range site. This soil is well drained. It has a surface layer of cobbly loam and a subsoil and substratum of very stony loam.

Runoff is medium on this soil, and permeability is moderately rapid.

The potential vegetation by weight on this site is about 50 percent decreaseers. The most important of these are alpine fescue, Thurber fescue, clovers, and kobresia. The major increaseers are native bluegrasses, sedges, alpine lily, dwarf goldenrod, moss silene, and indian paintbrush. If this site is not properly managed, bluegrasses, sedges, and annuals are dominant.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds per acre in moist years to 800 pounds per acre in dry years. About 75 to 90 percent of this yield is from plants that furnish forage for cattle.

#### BOTTOMLAND RANGE SITE

La Brier loam is the only soil in this range site. This soil is well drained. Slopes are 0 to 1 percent. The surface layer is loam, and the subsoil is heavy clay loam.

Runoff is medium, and this soil receives additional runoff water from adjacent soils. Permeability is slow. This soil is occasionally flooded.

The potential vegetation by weight on this site is about 60 percent decreaseers. The most important of these are alkali sacaton, western wheatgrass, fourwing saltbush, and vine-mesquite. Increaseers make up the remaining 40 percent. These are blue grama, galleta, and dropseed. If this site is not properly managed, annual weeds are dominant.

Brush control is well suited to this site. Range seeding is difficult because of the occasional flooding. All soils of this site are suited to the development of additional water sites for livestock.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 6,000 pounds per acre in moist years to 1,500 pounds per acre in dry years. About 80 to 90 percent of this yield is from plants that furnish forage for cattle.

#### CINDER RANGE SITE

This range site consists of well-drained soils in the Montoso series. Slopes are 5 to 60 percent. The soils in this range site have a surface layer of gravelly silt loam and a subsoil of light silty clay loam and very gravelly silty clay loam.

Runoff is medium to rapid on these soils, and permeability is moderate.

The potential vegetation by weight on this site is about 60 percent decreaseers. These are side-oats grama, little bluestem, western wheatgrass, Indian ricegrass, and New Mexico feathergrass. Increaseers make up the remaining 40 percent. The most important of these are rabbitbrush, blue grama, ring muhly, wolftail, galleta, pinyon, juniper, and cholla cactus.

If this site is not properly managed, ring muhly, three-awn, galleta, rabbitbrush, pinyon, and juniper become dominant. Proper management is the only suitable treatment for soils in this site.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,100 pounds per acre in moist years to 600 pounds per acre in dry years. About 70 to 85 percent of this yield is from plants that furnish forage for cattle.

#### CLAYEY RANGE SITE

This range site consists of well-drained soils in the Las Lucas and Moriarty series. Slopes are 0 to 9 percent. The soils in this range site have a surface layer of heavy loam or silty clay over a subsoil of clay loam or a clay layer.

Runoff is rapid on these soils, and permeability is slow or very slow.

The potential vegetation by weight on this site is about 50 percent decreaseers. The most important of these are alkali sacaton and western wheatgrass. The major increaseers are blue grama, galleta, ring muhly, broom snakeweed, and three-awn. If this site is not properly managed, three-awn, ring muhly, and broom snakeweed are dominant.

Although range seeding is possible on these soils, it is hazardous.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds per acre in moist years to 300 pounds per acre in dry years. About 75 to 80 percent of this yield is from plants that furnish forage for cattle.

#### HILLS RANGE SITE

This range site consists of well-drained soils in the Santa Fe series and the Stony rock land and Rock outcrop land types. Slopes are 5 to 100 percent. The soils in this range site are shallow to bedrock and are interspersed with Rock outcrop. Stones and cobblestones are common on the surface.

Runoff is rapid on these soils, and permeability is moderate.

The potential vegetation on this site is an open stand of pinyon and juniper. These trees are increaseers on this site. Other important increaseers are blue grama, galleta, three-awn, sand dropseed, and rabbitbrush. The major decreaseers in the understory are black grama, side-oats grama, pinyon ricegrass, and needle-and-thread. Decreaseers make up 50 percent by weight of production. If this site is not properly managed, pinyon, juniper, rabbitbrush, sand dropseed, and three-awn are dominant.

Treatment of the soils in this site is limited to management practices.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds per acre in moist years to 500 pounds in dry years. About 30 to 50 percent of the yield is from plants that produce forage for cattle.



**LOAMY RANGE SITE**

This range site consists of well-drained soils in the Agua Fria, Bernal, Calabasas, Cerrillos, Clovis, El Rancho, El Rancho variant, Fivemile, Hagerman, Harvey, La Fonda, Los Alamos, Panky, Prewitt, Rednun, Silver, Tapia, Willard, and Witt series. Slopes are dominantly 0 to 10 percent, but in places Calabasas soils have slopes of 10 to 20 percent. The soils in this range site have a surface layer of sandy loam, fine sandy loam, loam, or sandy clay loam and a subsoil of loam, sandy clay loam, clay loam, or clay.

Runoff is mostly medium on these soils, but it is rapid on Bernal and La Fonda soils. Permeability is moderate to slow.

This site has a potential for open grassland. Increasers make up about 50 percent of the vegetation by weight. The most important of these are blue grama and galleta. Other important increasers are ring muhly, sand dropseed, broom snakeweed, and three-awn. Decreasers make up the remaining 50 percent by weight of production. The most important of these are side-oats grama, black grama, Indian ricegrass, and western wheatgrass. If this site is not properly managed, ring muhly, broom snakeweed, and sand dropseed are dominant.

All soils of this site respond to range improvement practices. Range seeding and the development of water sites for livestock are practices that are well suited to these soils.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,400 pounds per acre in moist years to 400 pounds per acre in dry years. About 80 to 90 percent of this yield is from plants that furnish forage for cattle.

**MALPAIS RANGE SITE**

This range site consists of well-drained soils in the Apache and Majada series. Slopes are 1 to 50 percent. The soils in this range site have a surface layer of stony fine sandy loam and a subsoil of light sandy clay loam to very cobbly sandy clay.

Runoff is medium to rapid on these soils, and permeability is moderate to slow.

If this site is in excellent condition, decreasers make up 60 percent by weight. The most important of these are black grama, side-oats grama, western wheatgrass, Indian ricegrass, bottlebrush squirreltail, needle-and-thread, New Mexico feathergrass, and little bluestem. The major increasers are blue grama, galleta, sand dropseed, three-awn, pinyon, and juniper (fig. 9). If this site is not properly managed, the less useful increasers—pinyon, juniper, and three-awn—are dominant.

Management practices are the only practical treatment for this site.

If this site is in excellent condition, the total annual air-dry herbage ranges from 700 pounds per acre in moist years to 300 pounds per acre in dry years. About 50 to 75 percent of this yield is from plants that furnish forage for cattle.

**MOUNTAIN SHALE RANGE SITE**

This range site consists of well-drained soils in the Chimayo, Cueva, and Ortiz series. Slopes are 5 to 100 percent. The soils in this range site have a surface layer of gravelly loam, stony loam, or very stony clay and a subsoil of loam to clay.

Runoff is medium to rapid on these soils, and permeability is moderate to very slow.

The potential vegetation on this site is 60 percent decreasers by weight. The most important of these are western wheatgrass, alkali sacaton, side-oats grama, and little bluestem. The major increasers are oak, galleta, blue grama, pinyon, juniper, dropseed, and buckwheat. If this site is not properly managed, pinyon, juniper, oak, blue grama, and galleta are dominant.

Treatment of the soils in this site is limited to management practices.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,300 pounds per acre in moist years to 600 pounds per acre in dry years. About 40 to 60 percent of this yield is from plants that furnish forage for cattle.

**MOUNTAIN VALLEY RANGE SITE**

Only the land type Alluvial land, gravelly, is in this range site. Slopes are 0 to 10 percent. The sediment in this well-drained land type is medium textured to moderately coarse textured. It contains gravel, cobblestones, and stones.

Runoff is medium on this land type, and permeability is rapid.

The potential vegetation on this site is 60 percent decreasers by weight. The most important of these are mountain muhly, side-oats grama, needle-and-thread, and little bluestem. The major increasers are western wheatgrass, blue grama, fringed sagebrush, and wolftail. If this site is not properly managed, Kentucky bluegrass, blue grama, fringed sagebrush, pinyon, and juniper are dominant.

This site is suited to reseeding and to mechanical brush control.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 3,500 pounds per acre in moist years to 3,000 pounds per acre in dry years. About 75 to 90 percent of this yield is from plants that furnish forage for cattle.

**RIVER BREAKS RANGE SITE**

This range site consists of soils in the Pojoaque series and in the land type Rough broken land. Slopes are 5 to 25 percent. The soils in this range site have textures of sandy clay loam and gravelly sandy clay loam. They are shallow to moderately deep, and they are dissected by intermittent drainage channels.

Runoff is rapid to very rapid on these soils, and permeability is moderate.

If this site is in excellent condition, the potential vegetation is 55 percent decreasers by weight. These are black grama, side-oats grama, little bluestem, Indian ricegrass, western wheatgrass, needle-and-thread, New Mexico feathergrass, and alkali sacaton. The most important increasers are blue grama, hairy grama, galleta, sand dropseed, pinyon, and juniper. If this site is not properly managed, pinyon and juniper are dominant.

Steepness limits the treatment of these soils to good range management (fig. 10).

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 700 pounds per acre in moist years to 300 pounds per acre in dry years.



Figure 9.—An area of Malpais range site, in excellent condition, on Apache stony fine sandy loam, 1 to 15 percent slopes.

About 65 percent of this yield is from plants that furnish forage for cattle.

#### SALT FLATS RANGE SITE

This range site consists of well-drained soils of the Galisteo series and Alluvial land, saline. Slopes are 0 to 3 percent. The soils in this range site have a surface layer of loamy sand, loam, or silty clay loam and underlying layers of clay loam to silty clay.

Runoff is rapid on these soils, and permeability is slow.

If this site is in excellent condition, the potential vegetation is 65 percent decreaseers by weight. These are alkali sacaton, fourwing saltbush, blue grama, western wheatgrass, and vine-mesquite. The most important increaseers (fig. 11) are mat muhly, galleta, and shadscale. If this site is not properly managed, shadscale is dominant.

Range seeding on this site is difficult, but if the soils are properly prepared, the response to seeding is frequently fairly good. Brush control is effective on this site. Gullies should be controlled in the Galisteo-Gullied land complex, level.

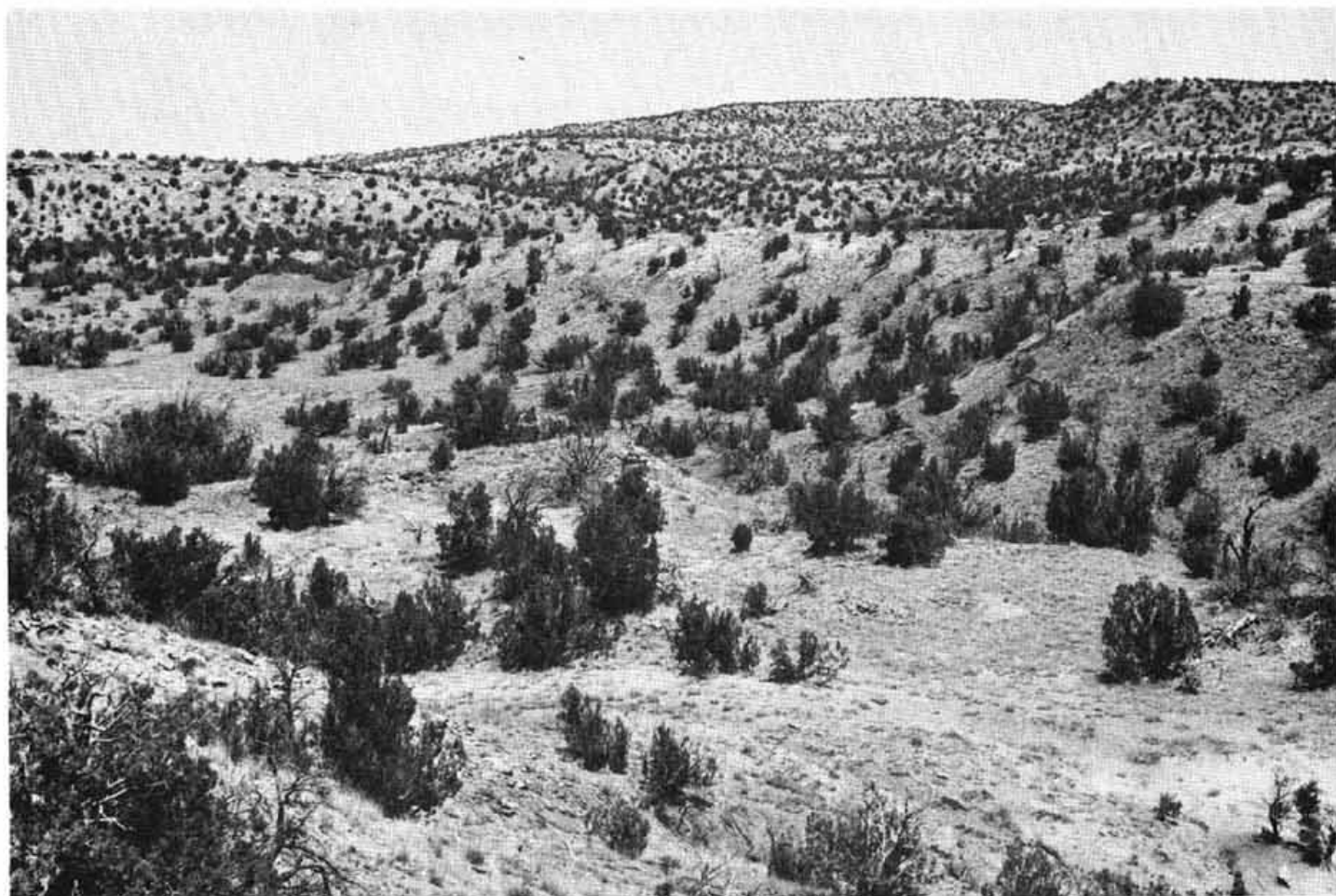
If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds per acre in moist years to 500 pounds per acre in dry years. About 80 to 90 percent of this yield is from plants that furnish forage for cattle.

#### SANDY RANGE SITE

This range site consists of well-drained to excessively drained soils in the Bluewing, Fruitland, Harvey, Otero, Palma, and Penistaja series. Slopes are 0 to 9 percent. The soils in this range site have a surface layer of sandy loam, fine sandy loam, or gravelly sandy loam and an underlying layers of gravelly loam or fine sandy loam to clay loam.

Runoff is medium to slow on these soils, and permeability is moderate to rapid.

If this site is in excellent condition, decreaseers make up 60 percent of the potential vegetation by weight. The most important of these are Indian ricegrass, black grama, side-oats grama, and western wheatgrass. The major increaseers are blue grama, galleta, sand dropseed, ring muhly, three-awn, and small soapweed (yucca) (fig. 12).



**Figure 10.**—An area of River Breaks range site on Pojoaque-Rough broken land complex.

If this site is not properly managed, ring muhly, three-awn, and small soapweed (yucca) are dominant.

Range seeding and brush control are practices well suited to these soils. Care must be taken to control soil blowing, however, because the soils are subject to erosion where they are denuded.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,500 pounds per acre in moist years to 650 pounds per acre in dry years. About 75 to 90 percent of this yield is from plants that furnish forage for cattle.

#### SHALLOW RANGE SITE

This range site consists of well-drained soils in the Dean, Laporte, Pastura, Pena, and Persayo series. Slopes are 1 to 25 percent. The soils in this range site have a surface layer of fine sandy loam, stony clay loam, or channery clay loam. Underlying layers are loam, sandy clay loam, very gravelly clay loam, or channery silty clay loam. Depth to bedrock, indurated caliche, or very gravelly layers is 6 to 20 inches.

Runoff is medium to rapid on these soils, and permeability is moderate to slow.

If this site is in excellent condition, the potential vegetation is 60 percent decreasers by weight. The most important of these are black grama, side-oats grama, New Mexico feathergrass, and needle-and-thread. The major increasers are blue grama, hairy grama, galleta, sand dropseed, Bigelow sagebrush, broom snakeweed, and three-awn. If this site is not properly managed, broom snakeweed is dominant.

The major range treatment is limited to range management practices.

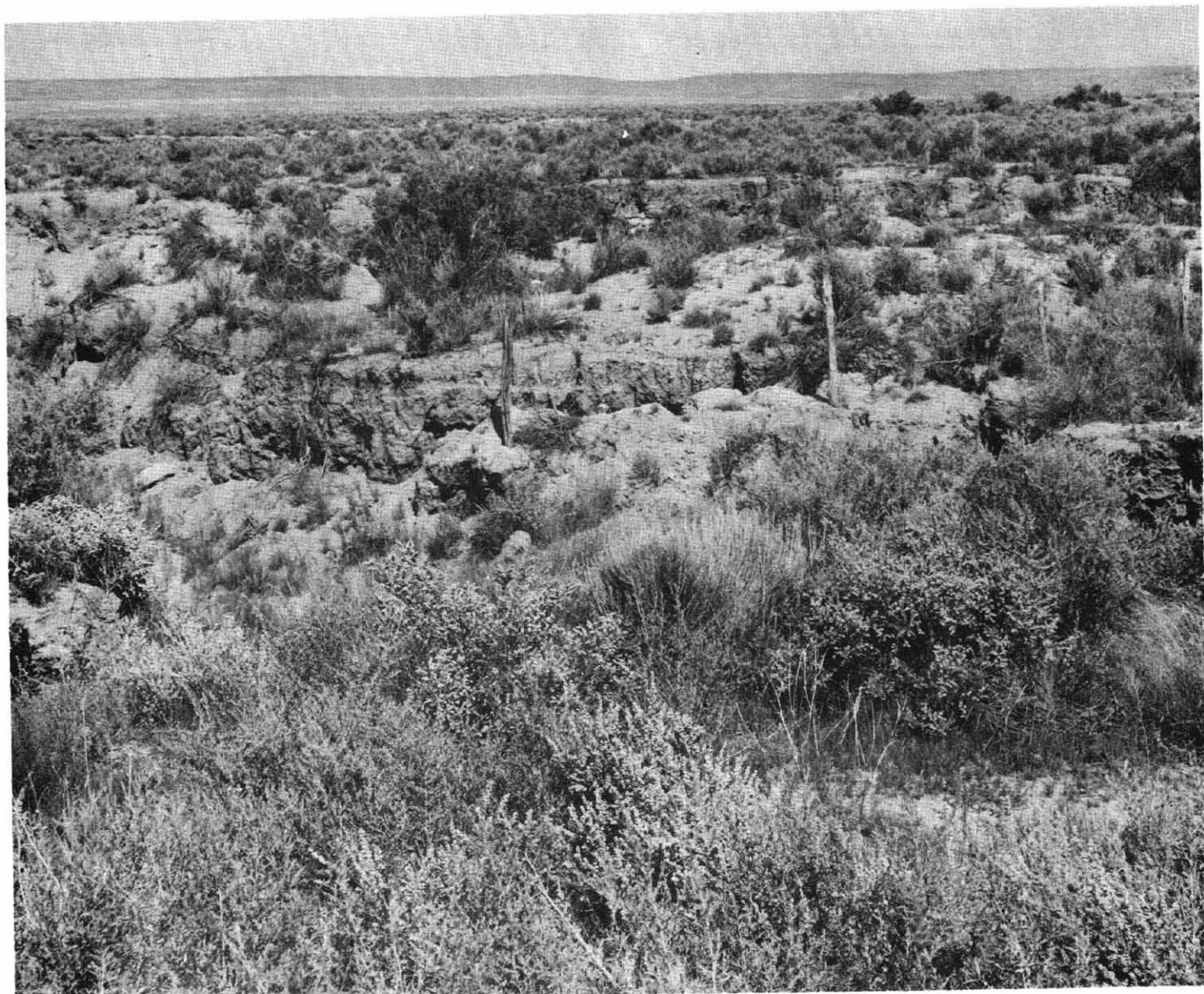
If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds per acre in moist years to 400 pounds in dry years. About 60 to 80 percent of this yield is from plants that furnish forage for cattle.

#### SHALLOW SANDSTONE RANGE SITE

This range site consists of well-drained soils in the Travessilla series. Slopes are 1 to 25 percent. The soils in this range site have a surface layer of loam or fine sandy loam and are underlain by sandstone at a depth of 6 to 18 inches.

Runoff is rapid on these soils, and permeability is moderate.





*Figure 11.*—An area of Salt Flats range site on Alluvial land, saline.

If this site is in excellent condition, the potential vegetation is 60 percent decrease by weight. These are black grama, needle-and-thread, side-oats grama, Indian ricegrass, and little bluestem. The most important increasers are Bigelow sagebrush, blue grama, sand dropseed, three-awn, broom snakeweed, pinyon, and juniper. If this site is not properly managed, pinyon and juniper and an understory of three-awn and broom snakeweed are dominant.

Proper management is important if desirable vegetation is to be maintained.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,400 pounds per acre in moist years to 700 pounds per acre in dry years. About 40 to 60 percent of this yield is from plants that furnish forage for cattle.

### Use of the Soils for Crops

Farming in the Santa Fe Area, capability groups of soils, use and management of soils by capability subclasses and units, and estimated yields of irrigated soils are discussed in this subsection.

Between 1900 and 1950 dryfarming in the southern part of the Santa Fe survey area consisted mostly of growing corn and beans. The acreage increased each year, reaching a maximum of about 20,000 to 22,000 acres during World War II. The main crop was beans. About 1950 the number of acres harvested began to decline. Then the drought of the early fifties and the beginning of the Conservation Reserve Program put most dryfarming to an end. Now only about 3,500 acres, nearly all in small grain, mainly wheat, are still dryfarmed.



Figure 12.—An area of Sandy range site in excellent condition on Otero-Palma fine sandy loams, 1 to 9 percent slopes.

According to the farmers in the Area at the time, the Soil Bank, or Conservation Reserve Program, was the salvation of the Area. Before the fields were reseeded to grass, dust storms were extremely severe. Now the land is covered with improved native grasses that are productive and that help to control soil blowing. It is estimated that most of this land will remain in grass.

### **Capability grouping**

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes. This classification, however, is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped

at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, timberland, or wildlife habitat. (No Class V soils are in the Santa Fe Area.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, timberland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict

their use largely to pasture or range, timberland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes.

**CAPABILITY SUBCLASSES** are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

Class I has no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, timberland, wildlife habitat, or recreation.

**CAPABILITY UNITS** are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1, or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability subclasses and units in the Santa Fe Area are described and suggestions for the use and management of the soils are given.

In each description the soil series represented in the subclass or unit are mentioned, but this does not necessarily mean that all the soils of the series are in the same capability subclass or unit. To determine the capability subclass or unit in which a soil has been placed, refer to that soil in the section "Descriptions of the Soils" or to the "Guide to Mapping Units" at the back of this survey.

### **Management of irrigated soils by capability units**

The capability classification of an irrigated soil in the Santa Fe Area differs from the capability classification of the same soil under dryland usage. Therefore, two sets of classifications must be made—one for soils that are irrigated and one for those that are used as timberland and rangeland.

In the following pages the capability classes, subclasses, and units of irrigated soils in the Santa Fe Area are given along with a brief description of the kinds of soil in each classification and their use and management.

In places the addition of fertilizer benefits crops. Non-leguminous plants respond to nitrogen and phosphorus. Legumes benefit in quality, and in many places in yield, if

phosphorus is applied. For most crops the existing amount of potassium is generally adequate.

#### **IRRIGATED CAPABILITY UNIT I-1**

This unit consists only of the well-drained sandy clay loam soil of the El Rancho series. This soil formed in mixed alluvium on terraces. Slopes are 0 to 1 percent. The average annual precipitation is 12 to 14 inches. The frost-free season is 160 to 170 days.

Permeability is moderate in this soil. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is about 60 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, range, and wildlife habitat. It is suited to all crops commonly grown in the Santa Fe survey area. Among these are deciduous fruits, alfalfa, small grains, corn, and truck crops.

This soil is comparatively high in mineral nutrients but is low in content of organic matter and nitrogen. No minor elements are known to be deficient.

Using green-manure crops in a suitable cropping system and returning crop residue to the soil help maintain the content of organic matter and maintain good structure. Excessive irrigation causes water loss and leaching of the soils, and it should be avoided. Excessive cultivation and cultivation when the soils are wet can cause plowsole formation and reduced infiltration of water. If this soil is reasonably well managed, erosion is not a serious concern.

This soil requires little leveling, but where leveling is needed, it can be done with few or no lasting injurious effects.

#### **IRRIGATED CAPABILITY UNIT IIe-1**

This unit consists of well-drained soils of the Ancho, Clovis, El Rancho, Fruitland, and Witt series. The dominant textures are sandy loam, loam, sandy clay loam, and clay loam. These soils formed in mixed alluvium on upland alluvial fans, on terraces, and, in some places, on flood plains. Slopes range from 0 to 5 percent but are mostly 0 to 3 percent. The average annual precipitation is 12 to 14 inches. The frost-free season ranges from 130 to 170 days, but for most areas it is 160 to 170 days.

Permeability ranges from moderately slow to moderately rapid but is moderate in most of the soils. The available water holding capacity ranges from 5 to 12.5 inches but is 5 to 9.5 inches for most of the soils. Effective rooting depth is 60 inches or more in some soils, but is 20 to 48 inches in others. Runoff is mostly medium, and the hazard of erosion is moderate unless the soils have adequate vegetative cover.

These soils are used for irrigated crops, range, and wildlife habitat. They are suited to most irrigated crops commonly grown in the survey area and for irrigated pasture (fig. 13).

Management practices are needed to control runoff and erosion, maintain soil fertility, and provide efficient use of irrigation water.

A crop that leaves a large amount of residue should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be applied or a cover crop can be grown.

In many places on this unit, land can be smoothed by cutting to considerable depth without reaching layers that have a high content of lime. Onsite studies, however, generally should be made before leveling for irrigation.





Figure 13.—A field of alfalfa on Witt loam, in irrigated capability unit IIe-1.

#### IRRIGATED CAPABILITY UNIT IIew-1

The well-drained La Brier loam is the only soil in this unit. It has a subsoil of clay loam and heavy clay loam. This soil formed in mixed alluvium in alluvial valleys. Slopes range from 0 to 1 percent. The average annual precipitation is 12 to 14 inches. The frost-free season is 130 to 140 days.

Permeability is slow in this soil. The available water holding capacity ranges from 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate if cover is not maintained.

This soil is used for irrigated crops, range, and wildlife habitat. It is suited to row and field crops, alfalfa, and truck crops (fig. 14).

The susceptibility of this soil to erosion and occasional flooding are minor concerns in management. Dikes or diversions are needed to control gully erosion and to prevent occasional flooding. A crop that leaves a large amount of residue on the surface and improves the soil should be grown 1 year in 3. These soils are friable and easy to cultivate, but excessive cultivation causes deterioration in tilth and reduces the intake of water.

Land leveling is generally needed to prepare these soils for irrigation. Cuts are not limited in depth. The soils are highly suitable for irrigation, and water can be applied by any of the common methods.

#### IRRIGATED CAPABILITY UNIT IIe-1

The well-drained Fruitland sandy clay loam, 0 to 3 percent slopes, is the only soil in this unit. The underlying material of this soil is fine sandy loam. This soil formed in mixed alluvium on alluvial fans. The average annual precipitation is 12 to 14 inches. The frost-free season is 160 to 170 days.

Permeability is moderately rapid in this soil. The available water holding capacity ranges from 6.5 to 7.5 inches. Effective rooting depth is about 60 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops and wildlife habitat. It is suited to row and field crops, orchards, and pasture.

Using green-manure crops in a suitable cropping system and returning crop residue to the soil help maintain the content of organic matter and maintain soil structure. A crop that leaves a large amount of residue and that improves the soil should be grown 1 year in 3.

Irrigation water should be applied carefully by sprinkler or contour irrigation to avoid erosion, to prevent leaching of nutrients, and to conserve moisture.

This soil requires little leveling, but where leveling is needed, it can be done with few or no lasting injurious effects.

#### IRRIGATED CAPABILITY UNIT IIIe-2

This unit consists of well-drained soils of the El Rancho and Fruitland series. The dominant textures are sandy clay



Figure 14.—A field of head lettuce on La Brier loam, in irrigated capability unit IIew-1.

loam and sandy loam. These soils formed in mixed alluvium on terraces and alluvial fans. Slopes are 3 to 5 percent. The average annual precipitation is 12 to 14 inches. The frost-free season is 160 to 170 days.

Permeability is moderate or moderately rapid in these soils. Available water holding capacity ranges from 6.5 to 9.5 inches. Effective rooting depth is about 60 inches. Runoff is medium, and the hazard of erosion is severe.

These soils are used for irrigated crops, range, and wildlife habitat. They are suited to row and field crops, orchards, and irrigated pasture.

Management practices are needed to control water erosion and soil blowing, provide efficient use of irrigation water, and maintain soil fertility. A crop that leaves a large amount of residue, such as small grain or grain sorghum, should be grown 1 year in 2. Terracing and farming on the contour can be used to conserve water and to help control erosion. In places terracing is not necessary if a field crop of small grain or grain sorghum is grown every year, and residue is left on the surface.

#### IRRIGATED CAPABILITY UNIT IIIe-3

The well-drained El Rancho sandy clay loam, sandy subsoil variant, is the only soil in this unit. Below the surface layer of this soil are layers of sandy clay loam and very gravelly fine sand. This soil formed in mixed alluvium on terraces. Slopes are 0 to 3 percent. The average annual precipitation is 12 to 14 inches. The frost-free season is 160 to 170 days.

Permeability is moderate in this soil. The available water holding capacity ranges from 4 to 5 inches. Effective rooting depth is 20 to 36 inches to the gravelly fine sand layer. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for irrigated crops, range, and wildlife habitat. It is suited to all shallow to moderately deep rooted crops commonly grown in the survey area. Among these are small grains, corn, and truck crops.

Using green-manure crops in a suitable cropping system and returning crop residue to the soil help maintain the content of organic matter and maintain good soil structure. Surface or sprinkler irrigation is suitable on this soil, but excessive irrigation causes water loss and leaching of the soil.

Where leveling is needed, the depth of cuts is somewhat restricted because of the moderate depth of the soil to the very gravelly fine sand layer.

#### IRRIGATED CAPABILITY UNIT IIIe-1

Only the well-drained Willard loam is in this unit. The underlying material of this soil is light clay loam. This soil formed in mixed alluvium and lake sediment in old lake depressions. Slopes range from 0 to 3 percent. The average annual precipitation is 12 to 14 inches. The frost-free season is 130 to 140 days.

Permeability is moderately slow in this soil. The available water holding capacity is 3.75 to 5 inches. Effective rooting depth is 20 to 48 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is used mostly for range and wildlife habitat. Small tracts are used for irrigated crops and are suited to small grain, alfalfa, corn silage and grain, potatoes, sugar beets, and beans.

Irrigation water should be applied carefully on this soil because of the restricted rooting depth. Adequate surface drainage is needed. Using green-manure crops in a suitable cropping system and returning crop residue to the soil help maintain the content of organic matter and maintain good structure.

Leveling must be done with care. Shallow cuts reduce the effective rooting depth, and deeper cuts expose the lacustrine material that has a high content of carbonates, gypsum, and other salts.

#### IRRIGATED CAPABILITY UNIT IVe-1

This soil is excessively drained. Bluewing loamy fine sand is the only soil in this unit. The underlying material is gravelly loam and very gravelly fine sand. This soil formed in mixed alluvium on terraces. Slopes range from 0 to 3 percent. The average annual precipitation is 12 to 15 inches. The frost-free season is 160 to 170 days.

Permeability is rapid in this soil. The available water holding capacity is 3 to 4 inches. Runoff is medium, and the hazard of erosion is severe. The depth to very gravelly fine sand is about 20 inches.

This soil is suited to alfalfa, irrigated pasture, and field crops.

Measures to control erosion are necessary because of slope and the coarse texture of the surface layer. If this soil is cultivated, cross-slope farming and stubble mulching help to protect it. Where this soil is irrigated, practices that help to control erosion and water loss are needed. Because of the low available water holding capacity, irrigation water should be applied frequently but in small amounts. Sprinkler irrigation is better suited than other types of irrigation. Using a suitable cropping system and returning crop residue to the soil help to maintain the content of organic matter and maintain soil structure.

Because the soil is 14 to 24 inches deep to very gravelly fine sand, it should be leveled with a minimum depth of cut.

**IRRIGATED CAPABILITY UNIT VIw-1**

This unit consists of saline soils of the Ancho, Bluewing, and Fruitland series. These soils have a fluctuating water table. The dominant textures are clay loam, sandy loam, and loamy fine sand. These soils formed in mixed alluvium on flood plains, terraces, and alluvial fans. Slopes are 0 to 3 percent. The average annual precipitation is 12 to 15 inches. The frost-free season is 160 to 170 days.

These soils are slightly to moderately saline. Permeability is moderately slow in some of the soils and moderately rapid or rapid in others. The available water holding capacity is 2 to 5 inches. Effective rooting depth is restricted by the fluctuating water table and generally is less than 40 inches. Runoff is slow, and the hazard of erosion is slight.

These soils are used for irrigated pasture and wildlife habitat. They are suited only to water- and salt-tolerant grasses, unless the soils are drained and the salts are removed by leaching. Where the gradient is adequate, drainage can be improved by open or tile drains. Irrigation water should be carefully applied to avoid raising the water table.

Land leveling is feasible if the soils are adequately drained, but deep cuts should be avoided because of the fluctuating water table.

***Management of dryland soils by capability subclasses***

In the following pages the capability classes and subclasses of soils used for timberland and rangeland in the Santa Fe Area are described.

**DRYLAND CAPABILITY SUBCLASS VIc**

This subclass consists of well-drained and excessively drained soils of the Agua Fria, Bluewing, Calabazas, Cerillos, Clovis, Dean, El Rancho, Fivemile, Fruitland, Hagerman, Harvey, La Fonda, Las Lucas, Los Alamos, Otero, Palma, Penistaja, Prewitt, Panky, Pojoaque, Rednun, Tapia, Silver, Willard, and Witt series. The dominant textures are sandy loam, fine sandy loam, and loam.

These soils formed mostly in old mixed alluvium; in material weathered from sandstone, shale, basalt, and volcanic debris; or in wind-laid sediment. They are mostly on uplands, alluvial fans, and terraces. Slopes range from 0 to 10 percent. The average annual precipitation is 12 to 15 inches, and the frost-free season is 130 to 170 days.

Permeability ranges from slow to rapid in these soils. The effective rooting depth is 10 to 60 inches. Runoff is mainly medium to rapid. Unless these soils have an adequate vegetative cover, the hazard of erosion is moderate or severe.

These soils are used for range and wildlife habitat. They are not suited to dryland crops. Additional information about use and management is given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife Habitat."

**DRYLAND CAPABILITY SUBCLASS VIew**

This subclass consists of well-drained soils of the La Brier and Moriarty series. These soils have a surface layer of loam or silty clay over a layer of clay loam or clay. They formed in mixed alluvium on alluvial fans and terraces. Slopes range from 0 to 5 percent. The average annual precipitation is 12 to 14 inches, and the frost-free season is 130 to 140 days.

Permeability is slow to very slow in these soils. Effective rooting depth is about 60 inches. Runoff is medium to rapid. Unless these soils have an adequate vegetative cover, the hazard of erosion is moderate to severe.

These soils are used mostly for range and wildlife habitat. Some areas of La Brier soils are used for irrigated crops. Additional information about use and management is given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife Habitat."

**DRYLAND CAPABILITY SUBCLASS VIIc**

This subclass consists of well drained and moderately well drained soils of the Adel, Bobtail, Borrego, Calabazas, Capillo, Chimayo, Cueva, Cundiyo, Encierro, Fortwingate, Galisteo, Guaje, Mirabal, Montoso, Nambe, Ortiz, Pena, Penitente, Pojoaque, and Supervisor series. Also included are soils of the McVickers series, kaolinitic variant; the Wilcoxson series, soft bedrock variant; and the Zuni series, brown subsoil variant. In addition, the land types Alluvial land, cobbly; Alluvial land, gravelly; Alluvial land, saline; Gullied land; and Rough broken land are in this subclass. The dominant textures are sandy loam, fine sandy loam, loam, and sandy clay loam. Many of the soils are gravelly or stony. They range from very shallow to deep to bedrock.

These soils formed mostly in material weathered from granite, gneiss, schist, sandstone, and shale or from basalt and other volcanic debris. A few formed in alluvium or valley fill. They are mostly on dissected uplands, on mountains, and on mountain foothills and mountain foot slopes. Some are on mesas, cinder cones, and lava flows, and a few are on flood plains. Slopes range from 0 to 80 percent, but are mostly 10 to 60 percent. Depending on elevation, the average annual precipitation ranges from 12 to 55 inches. Also depending on elevation, the frost-free season ranges from as few as 30 days in the highest part of the mountains to 170 days in the lower areas.

Permeability ranges from very slow to rapid in these soils. The effective rooting depth is 8 to 60 inches. Runoff is medium to rapid. Unless these soils have an adequate vegetative cover, the hazard of erosion ranges from moderate to severe but is mostly severe.

These soils are used mostly for range, as timberland, and for wildlife habitat. They are also used for water supply, recreation, and community development. Additional information about their use and management is given in the sections "Use of the Soils for Range," "Use of the Soils as Timberland," and "Use of the Soils for Wildlife Habitat."

**DRYLAND CAPABILITY SUBCLASS VIIw**

The only soil in this subclass is the poorly drained Lunch peat, shallow variant. The dominant textures are peat and silt loam. This soil formed in peat and alluvium derived from granite, gneiss, and schist. It is in mountain basins and valleys. Slopes range from 0 to 5 percent. The average annual precipitation is 35 to 45 inches, and the frost-free season is 30 to 50 days.

Permeability is slow in this soil. A fluctuating water table is at a depth of 0 to 10 inches. Effective rooting depth is about 60 inches. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used as timberland and for wildlife habitat and water supply. Additional information about use and



management is given in the section "Use of the Soils as Timberland."

#### DRYLAND CAPABILITY SUBCLASS VII<sub>a</sub>

This subclass consists of well-drained soils of the Apache, Bernal, Bobtail, Capillo, Chimayo, Dean, Laporte, Majada, Mirabal, Nambe, Pastura, Persayo, Santa Fe, Supervisor, and Travessilla series and Stony rock land. The dominant textures are fine sandy loam, loam, and clay loam. Many of the soils are stony or channery. Many are intermingled with outcrops of rock. These soils are dominantly very shallow to moderately deep, and depth to bedrock is mostly less than 30 inches.

These soils formed mostly in material weathered from granite, gneiss, schist, sandstone, shale, limestone, or basalt. They are mainly on uplands, mesas, and mountain foothills and foot slopes. Slopes range from 1 to 100 percent, but are mostly more than 20 percent. Depending on elevation, the average annual precipitation ranges from 11 to 40 inches, and the frost-free season ranges from 40 to 170 days.

Permeability ranges from slow to rapid in these soils.

The effective rooting depth is 6 to 60 inches. Available water holding capacity is dominantly low. Runoff is medium to rapid. Unless these soils have an adequate vegetative cover, the hazard of erosion is commonly moderate or severe.

These soils are used mostly for range, as timberland, and for wildlife habitat. They are also used for water supply, recreation, and community development. Additional information about use and management is given in the sections "Use of the Soils for Range," "Use of the Soils as Timberland," and "Use of the Soils for Wildlife Habitat."

#### DRYLAND CAPABILITY SUBCLASS VII<sub>b</sub>

The only mapping unit in this subclass is Badland. This land type is steep to very steep barren land broken by numerous intermittent drainage channels. It is suitable only for water supply, scenic value, and limited use for wildlife habitat (fig. 15).

#### DRYLAND CAPABILITY SUBCLASS VIII<sub>a</sub>

The only mapping unit in this subclass is Riverwash. This land type formed in sandy, gravelly, cobbly, and



Figure 15.—Badland as it forms on the Santa Fe formation.

bouldery alluvium along stream channels. The average annual precipitation is 12 to 16 inches, and the frost-free season is 130 to 160 days.

This land type is subject to periodic flooding and to shifting of soil material during normal high water. It has no vegetation except annual weeds and some saltcedars and cottonwoods.

This land type is used for water supply and as a source of sand and gravel.

#### DRYLAND CAPABILITY SUBCLASS VIII<sup>a</sup>

This subclass consists of varying kinds of geologic rock land. It consists of Basalt rock land, Rock outcrop, Shale rock land, Tuff rock land, and Rock slides.

These miscellaneous land types are not suitable for farming. They are suitable only for wildlife habitat and watersheds and for their recreational and scenic value.

#### Estimated yields of irrigated crops

Estimated average yields per acre of principal crops grown on irrigated soils of the Santa Fe Area under a high level of management are shown in table 2.

These are yields that can be expected over a period of years. They are based on information from research and from interviews with farmers and others who have knowledge of yields.

Table 2 shows the estimated yields of alfalfa, corn (silage and grain), potatoes, pinto beans, chili, barley, wheat, tame pasture, and apples. Soils that are used only for rangeland or timberland, however, are not included. Although crops other than those listed are grown in the survey area, yields for these crops are not listed because they

are grown only in small acreage, and reliable data on yields are not available.

The following are factors in high-level management:

1. A cropping system that provides adequate high-residue and soil-improving crops.
2. Adapted crop varieties or strains planted at the proper time and at the correct planting rate.
3. Recommended amounts and kinds of fertilizer applied at the proper time.
4. Careful tillage at the right time, with the right kinds of implements, and in such a way as to utilize crop residue, control weeds, and prevent excessive compaction.
5. Proper management or use of chemicals to control insects and plant diseases. Application of irrigation water, by means of a planned irrigation system, in amounts and at times that are in accord with the needs of crops.
6. Harvesting at proper time with correctly operated equipment.

If one or more of the preceding practices is omitted, a farmer may obtain average-level yields instead of high-level ones. For example, if a farmer manages at high level in all respects except for the control of insects and plant diseases, he may obtain yields that are lower than those expected under high-level management.

Yields higher than those given are not uncommon and can be obtained in favorable seasons under high-level management. These yields may change in the future as new crop varieties are developed to tolerate the diseases, insects, and the short growing season common to the Area.

TABLE 2.—Estimated average yields per acre of principal irrigated crops grown under a high level of management

[Absence of data indicates that the crop is not suited to the soil or that it is grown in very small amounts. Only arable soils are listed]

Soil	Alfalfa	Corn for silage	Corn for grain	Potatoes	Pinto beans	Chile	Barley	Wheat	Tame pasture	Apples
	Tons	Tons	Bu	Cwt	Cwt	Lb	Bu	Bu	A. U. M. <sup>1</sup>	Bu
Ancho clay loam.....	6					12, 000		55	20	
Ancho clay loam, saline.....									17	
Bluewing loamy fine sand.....	6							35	13	
Bluewing loamy fine sand, saline.....									11	
Clovis loam, 1 to 3 percent slopes.....	5	26	55	265	15		55	55		
El Rancho sandy clay loam, 0 to 1 percent slopes.....	7	31	75			17, 000	85	60	22	775
El Rancho sandy clay loam, 1 to 3 percent slopes.....	7	30	65			16, 000	75	50	20	700
El Rancho sandy clay loam, 3 to 5 percent slopes.....	5. 5	22	50			12, 000	55	45	15	550
El Rancho sandy clay loam, sandy subsoil variant.....	6	25	55			13, 000	60	50	16	600
Fruitland sandy loam, 0 to 3 percent slopes.....	6							35	15	625
Fruitland sandy loam, 3 to 5 percent slopes.....	5								12	475
Fruitland sandy loam, saline, 0 to 3 percent slopes.....									13	
Fruitland sandy clay loam, 0 to 3 percent slopes.....	6. 5	28					70	45	17	650
La Brier loam.....	6	32	65	325	18		65	65		
Willard loam.....	5	18	50	260	12		55	55		
Witt loam.....	6	30	60	325	16		70	65		

<sup>1</sup> A. U. M. = Animal-unit-month—the amount of forage or feed required to maintain one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

## Use of the Soils as Timberland <sup>3</sup>

Nearly 150,000 acres, or slightly more than ten percent, of the Santa Fe survey area is timberland. These wooded areas are at higher elevations where the environment is favorable for tree growth. Most of them are in the Santa Fe National Forest at elevations of 7,000 feet to 12,000 feet. Only those soils supporting commercial forest, however, are discussed in this section.

Ponderosa pine, Douglas-fir, white fir, aspen, and Engelmann spruce are the chief timber species in the survey area. Because precipitation increases and temperature decreases as elevation increases, the various timber species generally follow elevational zones. Engelmann spruce is the chief timber species growing at elevations of 10,000 feet or more. Douglas-fir, white fir, and aspen grow at elevations of 8,500 to 10,000 feet, but ponderosa pine is most common at elevations of 7,000 to 8,500 feet.

Aspect also has a strong influence on the growth of various tree species. For example, the south-facing slopes at an elevation of 9,000 feet have mostly pure stands of ponderosa pine, but the cooler north-facing slopes at the same elevation support Douglas-fir, white fir, and aspen. In general, stands of fir and ponderosa pine extend into the high elevations on south-facing slopes, and stands of spruce extend down to elevations of less than 10,000 feet on north-facing slopes and in the wetter bottom lands.

The main timber-producing soils are those of the Cundiyo, Nambe, Mirabal and Supervisor series (fig. 16). Other important wooded soils are Bobtail, Borrego, Fortwingate variant, McVickers variant, Zuni variant, Adel, and Wilcoxson variant. Some of the timber-producing soils are in the Pecos Wilderness, which has been withdrawn from timber harvesting areas. Others are in the Santa Fe Municipal Watershed, the scenic withdrawal above Hyde Park, and several study watersheds in the Rio Tesuque drainage area. Logging in these areas requires special timber harvest plans and programs. Many of the timber-producing soils are steep to very steep and have outcrops of rock. Thus, in the survey area, significant amounts of timber are not presently being harvested.

Pinyon pine and juniper are common at elevations of 6,000 to 7,000 feet, but in places on southerly exposures they are as high as 8,500 feet. Although pinyon pine and juniper are not generally considered marketable, they are used for firewood. Pinyon pine is also used for Christmas trees. It produces edible nuts. Both pinyon pine and juniper can be used for pulpwood, but juniper is now used almost entirely for fenceposts. The soils having better stands of pinyon pine and juniper are in the Ortiz, Cueva, Laporte, Pojoaque, Guaje, Chimayo, Majada, Apache, and Montoso series.

Timber production potential for each soil was made through use of site-index data gathered during the survey and by visual estimates. The productivity rating for ponderosa pine is based on site index curves developed by Meyer (3).

Site-index values for Douglas-fir and white fir were taken from curves developed by the Southwestern Region of the U.S. Forest Service. The site-quality class ratings for aspen and spruce are relative to the survey area and are based on visual estimates of the trees growing in the



Figure 16.—Dense spruce stand on Nambe stony loam, 20 to 70 percent slopes, eroded.

soils. Three site-quality classes are given for each timber species in the survey area. The site-index values as related to the site-quality classes for ponderosa pine, Douglas-fir, and white fir have been divided into three classes. A rating of high means that the site index, the average height of the dominant and codominant trees at 100 years, is 75 feet or more; a rating of medium means that the site index is 55 to 74 feet; and a rating of low means that the site index is 54 feet or less.

Several other items concerning timber production and harvest are pertinent. These include plant competition, natural regeneration, windthrow hazard, equipment limitations, erosion hazard, and forest management.

**Plant Competition.**—When a site has been disturbed by fire, cutting, or other factors, species of brush, trees, and other plants may invade the site. Such competition hinders the establishment and growth of desirable tree species. Plant competition is most serious on soils of higher fertility and on soils which favor competing plants. A rating of *slight* indicates that invasion by undesirable species has little effect on growth of desirable timber species. A rating of *moderate* indicates that competition does not seriously affect establishment of adequate stands of commercial timber species. A rating of *severe* indicates that competition is strong and interferes with natural regeneration. If seedlings are planted, the competing vegetation must be controlled.

Gambel oak is the chief source of competition in the ponderosa pine and mixed conifer stands. At the higher elevations, various types of shrubs, forbs, and grasses may be competitors.

**Natural Regeneration.**—Mainly because sandy loam and loam surface layers predominate, most of timber-producing soils have good potential for natural regeneration of timber species. In stony and rocky areas, however, timber does not regenerate well. In addition, natural regeneration is low on the steep south- and west-facing slopes where the drying effects of wind and sun are strong. In

<sup>3</sup> By L. D. WHEELER, JR., and J. A. WILLIAMS, soil scientists, U.S. Forest Service, Southwest Region, Albuquerque, New Mexico.



places, especially in areas of spruce, the thick duff layers seem to inhibit seedling establishment. Most of the soils that formed in alluvium have poor natural regeneration because of severe plant competition.

Because most of the soils are steep, contain a considerable amount of stone, and have outcrops of rocks, the use of mechanized tree planters is limited. Most areas require hand planting. Regeneration by plantation is most probable within existing stands where some protection is afforded from wind and sun. Also, soil moisture is more favorable on north-facing slopes than on south-facing slopes. Rocky areas should be avoided because soils in these areas are shallow and have low productivity. In the "Big Burn" areas of Nambe stony loam, 20 to 70 percent slopes, eroded, establishment of trees by artificial means is difficult. This soil is mainly on south aspects where it is subject to the drying effects of both sun and wind. Some type of shading is required to establish trees on these soils.

**Windthrow Hazard.**—Soil characteristics affect the growth of tree roots, and this in turn determines the resistance of the tree to the force of wind. Windthrow hazard is evaluated only on the basis of soil characteristics, and the evaluation does not include environmental factors, such as wind velocity, exposure, or density of stands.

Windthrow is not a severe hazard in the Area, except on the shallow, rocky soils or soils that have a dense, clayey subsoil or substratum. Anything that restricts normal root growth, such as bedrock at shallow depths, slowly permeable layers, a high water table, or poor drainage, increases susceptibility to windthrow damage.

If the rating is *slight*, soils are moderately deep to deep, are well drained, and have no restrictive layers. If the rating is *moderate*, soils generally are moderately deep, are well drained, and have no restrictive layers. Depth to bedrock, however, is extremely variable within short distances, and in places the soils are shallow.

**Equipment Limitations.**—These limitations refer to the restrictions imposed by soils and topography on the use of equipment in harvesting timber. Because most of the timber-producing soils in the Santa Fe survey area slope more than 30 percent, have a severe hazard of erosion, or are stony, the use of mechanized equipment in many areas is difficult. Needed haul roads and skid roads are costly to build and maintain. Rock outcrops and boulders interfere with the use of mechanized equipment. Very steep, rocky canyons make many areas of good timber inaccessible for logging by present methods. Areas where the subsoil or substratum is clayey have equipment limitations when wet.

An equipment limitation rating of *slight* indicates that there is no special hazard to the use of equipment. A rating of *moderate* indicates that not all types of equipment can be used and that the location and construction of haul roads, skid roads, landings, and similar constructions must take into account the susceptibility to erosion that these soils have. A rating of *severe* indicates that the type of equipment that can be used is limited and that special logging methods may have to be adopted. Use of equipment can cause serious damage to the structure and stability of the soil.

All the soils in timber have a brief seasonal restriction in use of equipment when they are soft and wet. This restriction is for a short period after frost leaves the soil in spring and occasionally during the rainy season in summer.

**Erosion Hazard.**—The susceptibility to erosion is based on inherent soil characteristics, such as slope, surface cover of stones and cobblestones, and aspect. Ratings of *slight*, *moderate*, and *severe* are used to indicate susceptibility to erosion where the soil is disturbed or where the protective cover of vegetation is destroyed or disturbed. Most of the soils in the survey area have a moderate to severe hazard of erosion, mainly because they are steep.

A rating of *slight* indicates that little erosion takes place where the plant cover has been disturbed or depleted. A rating of *moderate* indicates that disturbance of the surface layer and loss of protective vegetation result in conditions conducive to erosion. Careful planning in the construction of roads, skid trails, and landings is necessary to control soil loss. A rating of *severe* indicates that the soils are subject to serious erosion loss if the vegetation is removed or disturbed. Harvesting these soils must be done carefully, and special logging methods that minimize soil disturbance are advisable. All roads and skid trails must be carefully located and constructed, and they must be adequately drained to control excessive runoff. After logging has been completed, the roads must be seeded and treated to reduce runoff and curb soil-cutting and soil-washing.

### Forest management

Good forest-management practices include fire protection, protection from insects and disease, thinning and pruning to improve growth and quality, reforestation measures, cuttings to improve the basal area's stocking level, proper age-class distribution, and good management of the watershed.

The timberlands in the Area are under sustained-yield management. Mature and excess trees are removed by selective harvesting. The harvest of these trees helps to maintain proper stocking levels so that maximum growth is stimulated and sustained-yield capacity is assured.

Fire protection is provided through a system of look-outs, fire patrolmen, and practices that reduce the fire hazard. Proper silvicultural practices and direct-control methods provide protection from insects and disease. Non-commercial thinning, commercial cutting, and pruning of selected crop trees improves the quality of the timber and the growth potential of sites.

Reforestation is achieved by natural regeneration and by direct seeding and planting. Practices to control erosion in the timber-sale areas include treatment of skid trails, roads, and landings and other areas disturbed by logging operations. Among practices used are the construction of water bars; cross-ditching; seeding to grass, forbs, and browse; and scattering of slash in disturbed areas.

### Timber suitability groups

The soils in the timbered part of the Santa Fe Area vary greatly in soil characteristics, climate, and elevation. They have been placed in suitability groups that show the estimated relative production potential for ponderosa pine, Douglas-fir, white fir, aspen, and Engelmann spruce.

The 12 suitability groups are arranged in four sets of three groups each. The three suitability groups in each set represent Class 1, Class 2, and Class 3 in potential productivity for a particular tree species.

Table 3 lists the timber suitability groups, component soils, degree of limitation affecting tree growth, and degree

TABLE 3.—*Potential productivity of the soils for timber by timber suitability groups*

[Only soils managed primarily for commercial forest production are placed in timber suitability groups. Many soils are rated for more than one timber species]

Timber suitability group and map symbols	Species and productivity class	Degree of limitation affecting tree growth			Degree of limitation affecting timber harvest	
		Plant competition	Natural regeneration	Windthrow hazard	Equipment limitations	Erosion hazard
Group 1: FG, MC, ZU	Ponderosa pine: 1	Moderate	Good	Slight to moderate	Moderate to severe	Moderate to severe
Group 2: AD, AL, CC, CV, MD, SU, WC	Ponderosa pine: 2	Moderate	Fair to good	Moderate	Slight to severe	Moderate to severe
Group 3: BR, CE, EN, GL, ME, MF, SV	Ponderosa pine: 3	Moderate	Fair to poor	Severe	Moderate to severe	Severe
Group 4: AD, BM, FG, MC, ZU	Douglas-fir and white fir: 1	Moderate	Good	Slight to moderate	Moderate to severe	Moderate to severe
Group 5: AL, CC, CV, NB, SU, WC	Douglas-fir and white fir: 2	Moderate	Good	Moderate to severe	Moderate to severe	Moderate to severe
Group 6: BO, CE, MD, ME, MF, SV	Douglas-fir and white fir: 3	Moderate to severe	Fair to poor	Moderate to severe	Moderate to severe	Moderate to severe
Group 7: BM	Aspen: 1	Moderate	Fair to good	Slight	Moderate to severe	Severe
Group 8: AD, CV, FG, MC, NB	Aspen: 2	Moderate	Good	Slight	Severe	Moderate to severe
Group 9: AL, BO	Aspen: 3	Moderate	Fair	Slight	Moderate to severe	Severe
Group 10: NA	Engelmann spruce: 1	Moderate	Fair	Slight	Severe	Severe
Group 11: BM, NB, NE, NM	Engelmann spruce: 2	Moderate	Fair to poor	Slight	Severe	Severe
Group 12: BO, LU, NR	Engelmann spruce: 3	Moderate to severe	Fair to poor	Moderate	Severe	Slight to severe

of limitation affecting timber harvest. Many of the same soils are rated for more than one species of timber.

Soils rated Class 1 for production of ponderosa pine, Douglas-fir, white fir, aspen, and spruce are moderately deep to deep. They have a moderately thick to thick surface layer and a loam, clay loam, or clay subsoil and substratum. Soil reaction is neutral to strongly acid. The soil material throughout the profile is commonly less than 40 percent gravel, cobblestones, and stones.

Soils rated Class 2 for production of ponderosa pine, Douglas-fir, white fir, aspen, and spruce are shallow to moderately deep. They have a stony or gravelly sandy loam to loam surface layer and a dense clay subsoil or substratum. Soil reaction is neutral to strongly acid.

Soils rated Class 3 are commonly stony or steep or are at lower elevations.

The soil series represented are named in the description of each timber suitability group, but this does not necessarily mean that all the soils in a given series are in the same group. To find the timber suitability group of any given soil, refer to the "Guide to Mapping Units" at the back of this survey. Only soils primarily managed for commercial forest production are placed in timber suitability groups.

#### TIMBER SUITABILITY GROUP 1

This group consists of soils in the Fortwingate variant, McVickers variant, and Zuni variant series. These soils are in a high site-quality class for ponderosa pine.

Competition from other woody species generally is moderate but does not limit the establishment of a good stand

of pine on these soils. Conditions for natural regeneration are good.

The use of equipment is severely limited by the steepness of the Fortwingate variant and Zuni variant soils. The hazard of erosion is severe in areas of Fortwingate variant soils.

#### TIMBER SUITABILITY GROUP 2

This group consists of soils in the Adel, Capillo, Cundiyo, Mirabal, Supervisor, and Wilcoxson series and the land type Alluvial land, cobbly. These soils are in a medium site-quality class for ponderosa pine.

Competition from other woody species is moderate but does not limit establishment of a good stand of pine on these soils. Conditions for natural regeneration are fair to good.

The equipment limitation is slight to severe. The hazard of erosion ranges from moderate on the less sloping soils to severe on the steep soils.

#### TIMBER SUITABILITY GROUP 3

This group consists of soils in the Borrego, Capillo, Encierro, Guaje, Mirabal, and Supervisor series. These soils are in a low site-quality class for ponderosa pine. Conditions for natural regeneration are fair to poor, and the windthrow hazard is severe except on the Mirabal stony loam soils.

The equipment limitation is severe to moderate, and the use of rubber-tired machines is limited in rocky areas. The hazard of erosion is severe.

**TIMBER SUITABILITY GROUP 4**

This group consists of soils in the Adel, Bobtail, Fortwingate variant, McVickers variant, and Zuni variant series. These soils are in a high site-quality class for fir.

Woody plant competition is moderate but does not limit the establishment of a good stand of fir on these soils. Conditions for natural regeneration are good.

The equipment limitation is moderate to severe. It is severe in areas where slopes are steep. The hazard of erosion is moderate to severe.

**TIMBER SUITABILITY GROUP 5**

This group consists of soils in the Capillo, Cundiyo, Nambe, Supervisor, and Wilcoxson variant series and in the land type Alluvial land, cobbly. These soils are in a medium site-quality class for fir.

Plant competition is moderate, and condition for natural regeneration is good. Neither of these limits the establishment of a good stand of fir on these soils.

The hazard of windthrow is severe only on the Wilcoxson variant soils. The equipment limitation is moderate to severe, and the hazard of erosion is moderate to severe.

**TIMBER SUITABILITY GROUP 6**

This group consists of soils in the Bobtail, Capillo, Mirabal, and Supervisor series. These soils are in a low site-quality class for fir.

Competition from other woody species is moderate to severe. Conditions for natural regeneration are fair to poor.

The windthrow hazard is moderate to severe. Except on the less sloping Mirabal soil, the equipment limitation is severe, and the hazard of erosion is moderate to severe.

**TIMBER SUITABILITY GROUP 7**

Bobtail loam, 20 to 70 percent slopes, is the only soil in this group. This soil is in a high site-quality class for aspen.

Woody plant competition is moderate, and conditions for natural regeneration are fair to good.

The equipment limitation is severe, and the hazard of erosion is severe.

**TIMBER SUITABILITY GROUP 8**

This group consists of soils in the Adel, Cundiyo, Fortwingate variant, McVickers variant, and Nambe series. These soils are in a medium site-quality class for aspen.

Woody plant competition is moderate, and conditions for natural regeneration are good. Neither of these limits restocking.

The equipment limitation is severe on the steeply sloping soils, and the hazard of erosion is moderate to severe.

**TIMBER SUITABILITY GROUP 9**

This group consists of soils in the Bobtail series and the land type Alluvial land, cobbly. These soils and land type are in a low site-quality class for aspen. Conditions for natural regeneration are fair.

The equipment limitation is severe on the steep and very steep, rocky Bobtail soil. The hazard of erosion is severe on soils in this group.

**TIMBER SUITABILITY GROUP 10**

This group consists of only Nambe gravelly loam, 30 to 50 percent slopes. This soil is in a high site-quality class for spruce.

Competition from other woody species is moderate. Conditions for natural regeneration are fair.

Equipment limitation and the hazard of erosion are severe.

**TIMBER SUITABILITY GROUP 11**

This group consists of soils in the Bobtail and Nambe series. These soils are in a medium site-quality class for spruce.

Woody plant competition is moderate, and conditions for natural regeneration are fair to poor.

Equipment limitation and the hazard of erosion are severe.

**TIMBER SUITABILITY GROUP 12**

This group consists of soils in the Bobtail, Lunch variant, and Nambe series. These soils are in a low site-quality class for spruce.

Competition from other woody species is moderate to severe, and conditions for natural regeneration are fair to poor.

The equipment limitation is severe. The hazard of erosion is slight to severe.

**Use of the Soils for Wildlife Habitat**

The Santa Fe survey area has potential for many high-quality wildlife habitats. The suitability of the soils within each habitat to grow the kinds and amount of forage needed for wildlife ranges from poor to excellent. For example, the higher areas in the mountains are an excellent habitat for deer, elk, and turkey; but in places, the soils in this habitat are too shallow, wet, or rocky, or they have other characteristics that make them poorly suited as wildlife habitat. Thus, a habitat may have a suitable climate and vegetation to be high quality, but some soils in the habitat area may not be well suited to this use. In table 4 the soils of Santa Fe County are placed into wildlife-habitat groups and rated for suitability of habitat and wildlife species.

The *foothill trees and shrubs* habitat, which is an area just below the high mountains, is an excellent habitat for deer. It provides plenty of cover and browse. The *tall- or short-grass prairies* in the southern part of the survey area have potential as a high-quality antelope habitat. *Semi-desert shrubs and grasses* and *domestic seed and grain fields* are ideal habitats for dove and quail. Although the latter and *domestic grasses and hayland* are excellent habitat for pheasant, the density of the human population in these areas restricts pheasant population growth. Where water for flooding and cultivation is available, duck fields can be developed. In many areas the soils are suitable for fish ponds if water and water rights can be obtained.

**Wildlife habitat types**

Table 4 contains 10 elements of wildlife habitat. The suitability of each soil group for each element of wildlife habitat is rated good, moderate, or poor. Soils suitable for vigorous growth of a wide variety of the key species are rated good. Soils suitable for the growth of several key species are rated moderate. Soils that support none or a very few of the key species are rated poor.

*Mountain forest and grassland* are areas that have large trees and associated grasses, forbs, and shrubs in meadows or open parks. The key plants are fir, spruce, aspen, pon-

derosa pine, snowberry, buffaloberry, mountainmahogany, sedges, skunkbush sumac, serviceberry, cliffrose, bluegrass, and fescue.

*Bosque bottoms* are areas that receive extra water from flooding or irrigation but are not excessively wet. The key plants are cottonwood, willow, and tamarisk.

*Foothill trees and shrubs* are areas in mountains and on foothills that have small, native trees, shrubs, associated grasses, and forbs. The key plants are pinyon pine, one-seed juniper, blue grama, side-oats grama, mountainmahogany, gambel oak, and shrub live oak.

*Tall- or short-grass prairies* are areas of rolling plains and lower mountain slopes that have native grasses, shrubs, and forbs. The key plants are blue grama, bluestem, buffalograss, vine-mesquite, western wheatgrass, galleta, tobosa, cliffrose, serviceberry, and skunkbush sumac. Sunflowers, crotons, and pigweed grow in disturbed or water-ponded depressions.

*Semidesert shrubs and grasses* are areas of native grasses and shrubs. Key plants are alkali sacaton, three-awn, sand sagebrush, Apache plume, creosotebush, and cactus.

*Domestic seed and grain fields* are planted, cultivated fields where domestic grain and seeds produce annual herbaceous plants. The key plants are barley, corn, oats, grain sorghum, wheat, Japanese millet, and proso millet. This group is rated for both irrigated and nonirrigated uses.

*Domestic grasses and hayland* are areas planted to domestic perennial grasses and herbaceous legumes. Key plants are alfalfa, clover, tall wheatgrass, tall fescue, smooth brome, orchardgrass, and weeping lovegrass. The group is rated for both irrigated and nonirrigated uses.

*Wetland plants* are areas that are naturally moist to wet. They grow wetland plants but not submerged or floating aquatics. The key plants are saltmarsh bulrush, saltgrass, and cattail.

*Shallow-water impoundments* are impoundments of water that generally do not exceed a depth of 3 feet. Soils for this habitat are rated on their suitability for shallow ponds and reservoirs. They are rated as to their suitability for retaining water and as to their limitations for producing plants which provide food for waterfowl.

*Deepwater impoundments* are excavated to an average depth of more than 3 feet.

### **Wildlife habitat groups**

Each wildlife habitat group in the Santa Fe Area is briefly described on the following pages. Each description gives the wildlife habitat group name, the soil characteristics that influence land use and the kinds and patterns of vegetation, and the suitability for local wildlife. The miscellaneous land types Badland, Riverwash, and Rock outcrop were not placed in a wildlife habitat group because they either are not suited to wildlife or are too variable.

The soil series represented are named in the description of each wildlife habitat group, but this does not necessarily mean that all the soils in a given series are in the same group. To find the wildlife habitat group for any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

#### **WILDLIFE HABITAT GROUP A**

This group consists of shallow to deep soils of the Bluewing, Dean, El Rancho, Fruitland, Harvey, Pastura, Persayo, and Tapia series. These soils formed in sand, shale, and hard and soft caliche. They have a moderately

coarse textured to moderately fine textured surface layer. Permeability is very rapid to slow.

The soils of this group are suitable for tall- and short-grass prairies wildlife habitat, and they have excellent potential as habitat for antelope. They are also suitable for semidesert shrubs and grasses wildlife habitat. Their potential as habitat for dove and quail is fair to good. The soils of this group are generally too shallow or too sandy for shallow-water and deepwater impoundments.

#### **WILDLIFE HABITAT GROUP B**

This group consists of deep soils in the Calabasas, Cerrillos, Harvey, Los Alamos, Panky, Rednun, and Silver series. They have a medium-textured to moderately coarse textured surface layer. Permeability is moderate to slow.

The soils of this group are suitable for foothill trees and shrubs wildlife habitat, and they have good to fair potential as habitat for deer. They are also suitable for semidesert shrubs and grasses wildlife habitat. Their potential as habitat for dove and quail is fair to good. Where irrigated, the soils are suitable for domestic seed and grain fields and domestic grasses and hayland wildlife habitat, and they have good potential as habitat for all wildlife in the area except elk and turkey. These soils are suitable for tall- and short-grass prairies wildlife habitat, and they have excellent potential as habitat for antelope. Where irrigated, the soils are suitable for shallow-water impoundments and are good as habitat for ducks. The soils are well suited as habitat for fish in deepwater impoundments.

#### **WILDLIFE HABITAT GROUP C**

This group consists of deep soils of the Fivemile, Harvey, La Brier, La Fonda, Las Lucas, Otero, Palma, and Penistaja series. They have a medium-textured to moderately coarse textured surface layer. Permeability is slow to moderately rapid.

The soils in this group are suitable for tall- and short-grass prairies wildlife habitat, and they have excellent potential as habitat for antelope. These soils are also suitable for semidesert shrubs and grasses wildlife habitat, and they have good potential as habitat for dove and quail. Where irrigated, the soils are suitable for domestic seed and grain fields habitat and domestic grasses and hayland habitat. Irrigated areas provide habitat for most wildlife in the area except elk and turkey. The soils are moderately suited as habitat for duck and fish in shallow-water and deepwater impoundments.

#### **WILDLIFE HABITAT GROUP D**

This group consists of deep and moderately deep soils in the Agua Fria and Hagerman series. They have a moderately coarse textured surface layer over sandstone or gravel and cobblestones. Permeability is slow to moderate.

The soils in this group are suitable for the foothill trees and shrubs wildlife habitat, and they have good potential as habitat for deer. They are also suitable for tall- and short-grass prairies wildlife habitat, and they have fair potential as habitat for antelope. Where irrigated, the soils are suitable for domestic seed and grain fields habitat and for domestic grasses and hayland habitat. Irrigated areas provide habitat for most wildlife in the area except elk. The soils of this group are not suitable for shallow-water or deepwater impoundments for duck or fish.

TABLE 4.—*Suitability of the soils for elements*

Wildlife habitat groups and map symbols	Elements of wildlife habitat						
	Mountain forest and grassland	Bosque bottoms	Foothill trees and shrubs	Tall- or short-grass prairies	Semidesert shrubs and grasses	Domestic seed and grain fields	
						Irrigated	Nonirrigated
Group A: Bg, BH, DP, EL, HD, PH, TA.	Poor.....	Poor.....	Poor.....	Good.....	Moderate...	Poor.....	Poor.....
Group B: CA, CB, Cf, CG, Ch, HR, LS, Pa, PB, RD, SR.	Poor.....	Poor.....	Moderate...	Moderate...	Moderate...	Moderate...	Poor.....
Group C: Fe, FF, HC, HP, LB, Lf, LL, OP, PD.	Poor.....	Poor.....	Poor.....	Good.....	Moderate...	Moderate...	Poor.....
Group D: AF, HA.....	Poor.....	Poor.....	Good.....	Moderate...	Moderate...	Moderate...	Poor.....
Group E: CO, GG, MO, PR, WL, WN.	Poor.....	Poor.....	Poor.....	Good.....	Moderate...	Good.....	Poor.....
Group F: AG, AM, AP, BD, CM, CU, EN, GL, Lg, LH, MA, MG, MH, OG, PC, PK, Pm, PN, RE, RG, RL, RU, SF, Sk, SM, SP, ST, TB, TR, TU.	Poor.....	Poor.....	Good.....	Moderate...	Moderate...	Poor.....	Poor.....
Group G: AL, BM, BO, CC, CE, CV, FG, MC, MD, ME, MF, NA, NB, NE, NM, NR, PE, SU, SV, ZU.	Good.....	Poor.....	Poor.....	Poor.....	Poor.....	Poor.....	Poor.....
Group H: AD, BR, LU, WC.....	Moderate...	Poor.....	Poor.....	Poor.....	Poor.....	Poor.....	Poor.....
Group I: An, Ao, Ec, Ed, Ee.....	Poor.....	Good.....	Poor.....	Moderate...	Moderate...	Moderate...	Poor.....
Group J: Be, Bf, Eh, Fn, Fr, Fs, Ft.	Poor.....	Good.....	Poor.....	Moderate...	Moderate...	Moderate...	Poor.....

<sup>1</sup> Poor if habitat areas are not irrigated.

*of wildlife habitat and for wildlife species*

Elements of wildlife habitat—Continued					Wildlife species		
Domestic grasses and hayland		Wetland plants	Shallow-water impoundments	Deepwater impoundments	Poor	Good to fair	Excellent
Irrigated	Nonirrigated						
Poor.....	Poor.....	Poor.....	Poor.....	Poor.....	Duck, deer, turkey, pheasant, elk, fish.	Dove, quail.....	Antelope.
Moderate.....	Poor.....	Poor.....	Good.....	Good.....	Turkey, elk.....	Pheasant, <sup>1</sup> antelope, deer.	Fish, dove, <sup>2</sup> quail, <sup>2</sup> duck.
Moderate.....	Poor.....	Poor.....	Moderate.....	Moderate.....	Turkey, elk, deer..	Pheasant, <sup>1</sup> duck, fish.	Dove, <sup>2</sup> quail, <sup>2</sup> antelope.
Moderate.....	Poor.....	Poor.....	Poor.....	Poor.....	Turkey, duck, fish, elk.	Pheasant, <sup>1</sup> antelope.	Deer, dove, <sup>2</sup> quail. <sup>2</sup>
Good.....	Poor.....	Poor.....	Good.....	Good.....	Turkey, deer, elk..	-----	Fish, pheasant, <sup>1</sup> dove, <sup>2</sup> quail, <sup>2</sup> antelope, duck.
Poor.....	Poor.....	Poor.....	Poor.....	Poor.....	Turkey, pheasant, duck, fish, elk.	Dove, quail, antelope.	Deer.
Poor.....	Poor.....	Poor.....	Poor.....	Poor.....	Pheasant, dove, fish, quail, antelope, duck.	-----	Turkey, elk, deer.
Poor.....	Poor.....	Moderate.....	Poor.....	Poor.....	Pheasant, quail, dove, antelope, fish.	Elk, turkey, duck, deer.	
Moderate.....	Poor.....	Moderate.....	Good.....	Good.....	Turkey, elk, deer..	Antelope.....	Pheasant, <sup>1</sup> dove, <sup>2</sup> quail, <sup>2</sup> fish, duck.
Moderate.....	Poor.....	Poor.....	Poor.....	Poor.....	Elk, turkey, deer, duck, fish.	Antelope, pheasant. <sup>1</sup>	Dove, <sup>2</sup> quail. <sup>2</sup>

<sup>2</sup> Good to fair if habitat areas are not irrigated.



**WILDLIFE HABITAT GROUP E**

This group consists of deep soils in the Clovis, Galisteo, Moriarty, Prewitt, Willard, and Witt series. They have a medium-textured to fine-textured surface layer. Permeability is moderate to slow.

The soils in this group are suitable for tall- and short-grass prairies wildlife habitat type, and they have good potential as habitat for antelope. They are also suitable for the semidesert shrubs and grasses wildlife habitat type. Their potential as habitat for dove and quail is fair. Where irrigated, the soils are suitable for domestic seed and grain fields and domestic grasses and hayland wildlife habitat. Irrigated areas provide habitat for pheasant, dove, quail, and ducks. The Galisteo soils are not so well suited to irrigation as the other soils because of common gullies. The soils in this group are suitable for shallow-water and deepwater impoundments for duck and fish.

**WILDLIFE HABITAT GROUP F**

This group consists of very shallow to deep soils in the Apache, Bernal, Chimayo, Cueva, Encierro, Guaje, La Fonda, Laporte, Majada, Montoso, Ortiz, Panky, Pena, Pojoaque, Rednun, Santa Fe, Silver, and Travessilla series. Also in this group are the miscellaneous land types Alluvial land, gravelly; Alluvial land, saline; Basalt rock land; Rock outcrop; Rough broken land; Stony rock land; and Tuff rock land. These soils and land types formed in basalt, cinders, tuff, limestone, granite, and sandstone. They have a moderately coarse textured to fine-textured surface layer. Permeability is rapid to very slow.

The soils of this group are suitable for foothill trees and shrubs wildlife habitat, and they have excellent potential as habitat for deer. They are also suitable for tall- and short-grass prairies wildlife habitat. Their potential as habitat for antelope is good. They are suitable for semidesert shrubs and grasses wildlife habitat, and they have potential as habitat for dove and quail. The soils of this group have limited vegetation use for other types of wildlife habitat.

**WILDLIFE HABITAT GROUP G**

This group consists of very shallow to deep soils in the Bobtail, Capillo, Cundiyo, Fortwingate variant, McVickers variant, Mirabal, Nambe, Penitente, Supervisor, and Zuni variant series and the Alluvial land, cobbly land type. They have a moderately coarse textured to medium-textured surface layer, and there are rock outcrops of granite, gneiss, and schist.

The soils in this group are suitable for the mountain forest and grassland wildlife habitat, and they have excellent potential as habitat for deer, elk, and turkey. These soils have limited use for other types of wildlife habitat. They are not suited to shallow-water or deepwater impoundments.

**WILDLIFE HABITAT GROUP H**

This group consists of deep soils in the Adel, Borrego, Lunch variant, and Wilcoxson variant series. They have a medium-textured surface layer. Permeability is slow to moderate.

The soils in this group are suitable for mountain forest and grassland wildlife habitat, and they have fair to good potential as habitat for elk, deer, turkey, and ducks. These soils have limited use for other types of wildlife habitat. The Lunch variant soil of this group is suitable for deep-

water impoundments, and it provides an excellent habitat for fish.

**WILDLIFE HABITAT GROUP I**

This group consists of deep soils in the Ancho and El Rancho series. They have a moderately fine textured surface layer. Permeability is moderate.

The soils in this group are suitable for bosque bottoms, domestic seed and grain fields, domestic grasses and hayland, and wetland plants wildlife habitat. They have good potential as habitat for pheasant, dove, quail, and ducks. These soils are also suitable for tall- and short-grass prairies wildlife habitat. They have potential as habitat for antelope, but most areas are irrigated and are around heavily populated areas. The soils in this group are rated good for shallow-water and deepwater impoundments for wildlife habitat.

**WILDLIFE HABITAT GROUP J**

This group consists of shallow to deep soils in the Bluewing, El Rancho variant, and Fruitland series. They have a coarse to moderately fine textured surface layer. Permeability is moderate to rapid.

The soils in this group are suitable for semidesert shrubs and grasses, domestic seed and grain fields, and domestic grasses and hayland wildlife habitat. They have good potential as habitat for dove and quail and fair potential as habitat for pheasants. The soils are suitable for tall- and short-grass prairies wildlife habitat. Their potential as habitat for antelope is fair, but the soils are mostly irrigated and are around heavily populated areas. The substratum of these soils is too sandy to impound water for fish or duck ponds.

## Engineering Uses of the Soils

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. This section describes or lists those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water-storage facilities, erosion-control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, drainage, shrink-swell potential, water-holding capacity, grain-size distribution, plasticity, and reaction. Also important are depth to water table and depth to bedrock.

Information concerning these and related soil properties is furnished in Tables 5, 6, and 7. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning and designing farm ponds, irrigation systems, and other structures used for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

The suitability of soils for grading in winter varies from year to year, depending on the moisture content of

the soil and the temperature. Some winters soil moisture is low, and little frost forms in the soil. Then, if temperature is high enough, moisture can be added to provide proper conditions for earth construction. If soil moisture is high and the temperature is extremely low for extended periods, however, earth movement generally is postponed.

At many construction sites major soil variations may be present within the depth of proposed excavation, and several different soils may be found within a short distance. The soil map and profile descriptions, as well as the engineering data and suggestions given in this section, should be used in planning detailed surveys of soils at construction sites. Use of the information in this survey will enable the soil engineer to concentrate on the most suitable soils. Then a minimum number of soil samples will be required for laboratory testing, and an adequate soil investigation can be made at minimum cost.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected. The estimates are generally to depths of about 5 feet, and therefore interpretations normally do not apply to greater depth. Small areas of other soils are included in the mapping units.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, clay, surface soil, subsoil, and horizon. These and other terms are defined in the glossary at the back of this publication.

### **Engineering classification systems**

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHTO system, adopted by the American Association of State Highway Officials, and the Unified system, used by Soil Conservation Service engineers, the Department of Defense, and others. These classification systems are explained in the *PCA Soil Primer* (4).

The AASHTO system classifies soils according to properties that affect use in highway construction and maintenance (1). In this system a soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high shear strength, or the best soils for subgrade (foundation); and at the other extreme, in group A-7, are clay soils that have low shear strength when wet. The best soils for subgrade, therefore, are classified as A-1, the next best, A-2, and so on to class A-7, the poorest soils for subgrade. When laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, and A-7-5, A-7-6. If soil material is near a classification boundary, it is given a symbol showing both classes, for example, A-2 or A-4. Within each group, the relative engineering value of a soil material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHTO

classification for tested soils, with index numbers in parentheses, is shown in table 7; the estimated classification for all soils mapped in the survey area is given in table 5.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter (10). Soils are grouped in 15 classes. Eight classes are coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes are fine-grained soils, identified as ML, CL, OL, MH, CH and OH; and one class is highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by a symbol for both classes; for example, ML-CL.

### **Estimated engineering properties**

Table 5 provides estimates of soils properties significant to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and from detailed experience in working with the individual kind of soil in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

The estimated percentage of coarse fraction greater than 3 inches and of soil material passing sieves No. 4, 10, 40, and 200 reflects the normal range for a soil series. Most soils are within the range given. However, the grain size of any soil varies considerably. It should not be assumed, therefore, that all samples of a specific soil will fall within the range shown, nor that the engineering classification will invariably be as shown.

Permeability, as used in table 5, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on soil texture, structure, density, and porosity. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water holding capacity (available moisture capacity) is that amount of capillary water in the soil available for plant growth after all free water has drained away.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected in a soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Corrosivity, as used here, indicates the potential danger to uncoated steel through chemical action that dissolves or weakens the structural material. Structural material may corrode when buried in soil, and in some kinds of soil a given material corrodes more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear in the first column of this

Soil series and map symbols	Depth to bedrock	Depth from surface in representative profile	Classification		
			USDA texture	Unified	AASHO
Adel: AD.....	Feet >5	Inches 0-60	Loam.....	ML	A-4
Agua Fria: AF.....	>5	0-4 4-21 21-30 30-60	Fine sandy loam..... Heavy clay loam..... Sandy loam..... Gravel and cobblestones.....	ML CL SM GW-GM or GM	A-4 A-6 or A-7 A-2 or A-4 A-1
Alluvial land, cobbly: AL. Too variable for valid interpretation.					
Alluvial land, gravelly: AG. Too variable for valid interpretation.					
Alluvial land, saline: AM. Too variable for valid interpretation.					
Ancho: <sup>1</sup> An, Ao.....	>5	0-60	Clay loam.....	CL	A-6
Apache: AP.....	1-1½	0-16 16	Stony fine sandy loam and sandy clay loam. Bedrock.	SM or SC	A-4 or A-6
Badland: BA. Too variable for valid interpretation.					
Basalt rock land: BD. Too variable for valid interpretation.					
Bernal.....	¾-1½	0-7 7-18 18	Fine sandy loam and very fine sandy loam. Clay loam..... Bedrock.	SM or ML CL	A-4 A-6
Bluewing: <sup>2</sup> Be, Bf, Bg, BH.....	>5	0-20 20-60	Gravelly sandy loam and gravelly loam. Very gravelly fine sand.....	SM GP-GM or GM	A-2 or A-4 A-1
Bobtail: BM, BO..... Rock outcrop part of BO is too variable for valid interpretation.	1½-3½	0-36 36	Stony loam (loam surface layer).. Bedrock.	ML	A-4
Borrogo: BR.....	1-1½	0-6 6-13 13-18 18	Loam and heavy clay loam..... Gravelly clay..... Gravelly sandy clay loam..... Bedrock.	CL CH SC	A-6 or A-7 A-7 A-6 or A-2
Calabasas: CA, CB.....	>5	0-60	Loam and clay loam.....	CL or ML	A-6 or A-4
Capillo: CC, CE..... Rock outcrop part of CE is too variable to be rated.	>3½	0-7 7-15 15-60	Gravelly sandy loam..... Sandy clay loam..... Clay and gravelly clay.....	SM SC CH	A-2 A-6 A-7
Cerrillos: Cf, CG, Ch.....	>5	0-5 5-30 30-60	Fine sandy loam..... Clay loam..... Sandy clay loam.....	SM CL SC	A-4 A-6 or A-7 A-6
Chimayo: CM.....	1-1½	0-20 20	Very stony loam..... Bedrock.	ML	A-4
Clovis: CO.....	>5	0-34 34-60	Clay loam and sandy clay loam.. Fine sandy loam.....	SC or CL SM	A-6 A-4

See footnotes at end of table.

*significant to engineering*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions table. The symbol > means more than and the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water holding capacity	Reaction (1:5 dilution)	Shrink-swell potential	Corrosivity to uncoated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
<i>Percent</i>					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>		
		100	85-95	60-70	0.63-2.0	0.16-0.18	6.6-7.3	Low to moderate	Low.
	90-100	85-100	70-80	50-60	2.0-6.3	0.13-0.15	7.9-8.4	Low	Low.
		100	90-100	75-85	0.2-0.63	0.19-0.21	7.9-9.0	High	High.
		100	60-70	30-40	2.0-6.3	0.11-0.13	8.5-9.0	Low	Low.
25-40	45-55	20-30	15-25	5-15	6.3-20.0		8.5-9.0	Low	Low.
		100	90-100	70-80	0.02-0.63	0.19-0.21	7.9-9.0	Moderate	Moderate.
15-40	85-95	75-85	65-75	40-50	0.63-2.0	0.11-0.13	7.9-9.0	Low	Low to moderate.
		100	70-90	40-60	2.0-6.3	0.13-0.15	6.6-7.3	Low	Low.
		100	90-100	70-80	0.63-2.0	0.19-0.21	6.6-7.3	Moderate	Moderate.
	75-85	65-80	55-70	30-50	2.0-6.3	0.06-0.08	7.4-8.4	Low	Low.
	20-40	15-35	10-30	5-15	6.3-20.0	0.03-0.05	7.9-8.4	Low	Low.
40-50	90-100	85-95	80-90	50-60	0.63-2.0	0.12-0.14	4.5-5.0	Low	Low.
0-5		100	90-100	70-80	0.2-0.63	0.13-0.15	6.6-7.3	Moderate	Moderate.
	100	80-90	75-85	65-80	<0.06	0.10-0.12	6.6-7.3	High	High.
	80-90	70-80	55-75	25-40	0.63-2.0	0.10-0.12	6.6-7.3	Moderate	Moderate.
	95-100	90-100	85-100	65-80	0.63-2.0	0.18-0.20	7.4-8.4	Moderate	Moderate.
	80-90	75-85	50-60	25-35	2.0-6.3	0.07-0.10	6.6-7.3	Low	Low.
	95-100	90-100	75-85	40-50	0.2-0.63	0.14-0.16	6.6-7.3	Moderate	Moderate.
	85-100	80-100	75-100	70-90	0.06-0.2	0.13-0.15	6.6-7.3	High	High.
		100	70-85	40-50	2.0-6.3	0.13-0.15	7.9-8.4	Low	Low.
		100	90-100	75-85	0.63-2.0	0.05-0.07	7.9-9.0	Moderate	Moderate.
		100	80-90	40-50	0.63-2.0		8.5-9.0	Low to moderate	Moderate.
40-50	90-100	80-90	70-80	50-60	0.63-2.0	0.08-0.10	6.6-7.3	Low	Low.
		100	85-95	45-60	0.63-2.0	0.17-0.19	7.9-8.4	Moderate	Moderate.
		100	70-85	40-50	2.0-6.3		7.9-8.4	Low	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface in representative profile	Classification		
			USDA texture	Unified	AASHO
Cueva: CU.....	Feet 1½-4	Inches 0-3 3-19 19-33 33	Very stony light clay..... Clay..... Silty clay loam..... Weathered bedrock.	CH CH CH or CL	A-7 A-7 A-7
Cundiyo: CV.....	>5	0-46 46-60	Very cobbly sandy loam and very cobbly loam. Very cobbly loamy sand.....	GM GM-GW or GM	A-2 or A-1 A-1
*Dean: DP..... For Pastura part, see Pastura series.	>5	0-9 9-60	Loam..... Soft caliche of very gravelly loam texture.	CL or ML GM	A-4 A-2 or A-4
*El Rancho: Ec, Ed, Ee, EL..... For Fruitland part of EL, see Fruitland series.	>5	0-60	Sandy clay loam.....	SC	A-6
El Rancho, variant: Eh.....	>5	0-22 22-60	Sandy clay loam..... Very gravelly fine sand.....	SC GP-GM or GM	A-6 A-1
Encierro: EN.....	½-1½	0-9 9-16 16	Stony fine sandy loam and sandy loam. Clay..... Bedrock.	ML or SM CL or SC	A-4 A-6
Fivemile: Fe, FF.....	>5	0-60	Loam and silt loam.....	ML or CL	A-4 or A-6
Fortwingate, variant: FG.....	3½-4½	0-13 13-50 50	Gravelly sandy loam..... Cobbly sandy clay loam..... Bedrock.	SM SC	A-2 A-6 or A-2
Fruitland: <sup>3</sup> Fn, Fr, Fs, Ft.....	>5	0-13 13-60	Sandy clay loam..... Fine sandy loam.....	SC SM	A-6 A-4
Galisteo: GG.....	>5	0-60	Silty clay (loam surface layer) ..	CH	A-7
Guaje: GL.....	>5	0-14 14	Very gravelly sandy loam..... Weakly cemented pumice.	GM or GW-GM	A-2
Hagerman: HA.....	1½-3½	0-40 40	Sandy clay loam..... Bedrock.	CL	A-6
*Harvey: HC, HD, HP, HR..... For Dean part of HD, see Dean series; for Penistaja part of HP, see Penistaja series; for Cerrillos part of HR, see Cerrillos series.	>5	0-60	Sandy clay loam and clay loam..	CL or ML	A-6 or A-4
La Brier: LB.....	>5	0-60	Clay loam.....	CL	A-6 or A-7
La Fonda: Lf.....	>5	0-42 42-60	Sandy clay loam..... Sandy loam.....	SC SM	A-6 A-2 or A-4
Laporte: Lg, LH..... Rock outcrop parts are too variable for valid interpretation.	½-1½	0-19 19	Cobbly and gravelly loam and sandy clay loam. Bedrock.	ML or CL	A-4 or A-6
Las Lucas: LL.....	3½-5	0-50 50	Clay loam..... Shale.	CL	A-6 or A-7
*Los Alamos: LS..... For Silver part, see Silver series.	>5	0-25 25-40 40-60	Clay loam and loam..... Gravelly sandy loam..... Pumice and ash (weakly cemented).	CL or ML SM GW-GM or GM	A-6 or A-4 A-2 A-1

See footnotes at end of table.



significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water holding capacity	Reaction (1:5 dilution)	Shrink-swell potential	Corrosivity to uncoated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
<i>Percent</i>					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>		
25-35	100	80-90	75-85	60-80	0.06-0.2	0.08-0.10	7.4-7.8	High-----	High.
		100	90-100	75-95	<0.06	0.10-0.12	6.6-8.4	High-----	High.
5-15	100	85-100	80-90	75-85	0.06-0.2	0.16-0.18	7.9-9.0	Moderate-----	Moderate.
20-30	40-50	35-45	30-40	20-35	2.0-6.3	0.08-0.10	6.1-7.3	Low-----	Low.
25-35	40-50	35-45	20-30	5-15	6.3-20.0	0.04-0.06	6.1-6.5	Low-----	Low.
		100	85-95	60-75	0.63-2.0	0.16-0.18	7.9-9.0	Low to moderate--	Moderate.
	50-60	45-55	40-50	25-40	0.06-0.2		8.5-9.0	Low-----	Moderate.
		100	80-90	35-50	0.63-2.0	0.14-0.16	7.9-8.4	Moderate-----	Moderate.
		100	80-90	35-50	0.63-2.0	0.14-0.16	7.9-8.4	Moderate-----	Moderate.
	25-35	20-30	15-25	5-15	6.3-20.0	0.04-0.06	7.9-8.4	Low-----	Low.
25-50		100	90-100	65-75	2.0-6.3	0.13-0.15	6.1-7.3	Low-----	Low.
	95-100	90-100	85-95	45-60	0.06-0.2	0.14-0.16	6.1-6.5	High-----	High.
		100	85-95	70-80	0.63-2.0	0.18-0.20	7.9-8.4	Moderate-----	Low.
0-10	80-90	75-85	45-60	25-35	2.0-6.3	0.07-0.09	6.6-7.3	Low-----	Low.
25-45	75-90	70-85	55-75	25-45	0.63-2.0	0.10-0.12	6.1-7.3	Low-----	Moderate.
		100	80-90	35-50	0.63-2.0	0.14-0.16	7.9-8.4	Low to moderate--	Moderate.
		100	70-85	40-50	2.0-6.3	0.11-0.13	7.9-8.4	Low-----	Low.
		100	90-100	75-95	0.06-0.2	0.15-0.17	8.5-9.0	High-----	High.
	35-50	30-45	20-35	10-20	6.3-20.0	0.08-0.10	7.4-8.4	Low-----	Low.
		100	80-90	50-60	0.63-2.0	0.14-0.16	6.6-8.4	Moderate-----	Moderate.
	95-100	90-100	80-90	50-60	0.63-2.0	0.16-0.18	7.9-8.4	Moderate-----	Moderate.
		100	90-100	70-80	0.06-0.2	0.18-0.20	7.9-8.4	Moderate-----	Moderate.
	95-100	90-100	80-90	35-50	0.63-2.0	0.14-0.16	7.9-8.4	Low to moderate--	Moderate.
	95-100	90-100	60-70	30-40	2.0-6.3	0.11-0.13	8.5-9.0	Low-----	Low.
10-25	80-90	75-85	65-80	50-65	0.63-2.0	0.12-0.14	8.5-9.0	Low-----	Low.
		100	90-100	70-80	0.06-0.2	0.18-0.20	7.9-9.0	Moderate-----	Moderate.
		100	85-95	65-75	0.63-2.0	0.16-0.18	7.4-8.4	Moderate-----	Moderate.
	80-90	75-85	45-55	25-35	2.0-6.3	0.07-0.09	8.5-9.0	Low-----	Moderate.
	40-50	10-20	5-15	5-15	2.0-6.3		8.5-9.0	Low-----	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface in representative profile	Classification		
			USDA texture	Unified	AASHO
Lunch, variant: LU .....	<i>Feet</i> >5	<i>Inches</i> 0-60	Silt loam (peat surface layer) .....	ML or CL	A-4 or A-6
Majada: MA .....	>5	0-7	Stony and cobbly fine sandy loam.	SM	A-4
		7-30	Very cobbly sandy clay loam and sandy clay.	SC	A-6
		30-60	Very cobbly loam .....	ML	A-4
McVickers, variant: MC .....	3½-5	0-9	Sandy loam .....	SM	A-2 or A-4
		9-14	Gravelly sandy clay loam .....	SC	A-6
		14-60	Clay .....	CH	A-7
Mirabal: MD, ME, MF .....	1½-2½	0-21	Very stony loam .....	SM	A-1
Rock outcrop part of MF is too variable for valid interpretation.		21	Bedrock.		
Montoso: MG, MH .....	>5	0-6	Gravelly silt loam .....	ML or CL	A-4
		6-18	Very gravelly silty clay loam .....	GC	A-7 or A-2
		18	Cinders.		
Moriarty: MO .....	>5	0-60	Clay .....	CH, CL or ML	A-7 or A-6
Nambe: NA, NB, NE, NM, NR .....	>5	0-60	Stony and very stony sandy loam.	SM	A-4 or A-2
Rock outcrop parts of NM and NR are too variable for valid interpretation.					
Ortiz: OG .....	1½-3½	0-28	Gravelly loam and clay loam .....	CL or ML	A-4 or A-6
		28	Shale.		
*Otero: OP .....	>5	0-60	Fine sandy loam .....	SM	A-4
For Palma part, see Palma series.					
Palma .....	>5	0-60	Fine sandy loam .....	SM	A-4
Mapped only in complex with Otero soils.					
Panky: Pa, PB .....	>5	0-24	Heavy clay loam .....	CL	A-6
		24-60	Sandy clay loam .....	ML or CL	A-4
Pastura .....	½-1½	0-16	Loam and gravelly loam .....	ML or CL	A-4
Mapped only with Dean soils.		16	Indurated caliche.		
Pena: PC .....	>5	0-13	Stony clay loam .....	CL	A-6
		13-24	Very gravelly clay loam .....	GC	A-4 or A-2
		24-60	Very gravelly loam (weakly cemented).	GM	A-2
Penistaja: PD .....	>5	0-30	Sandy clay loam .....	CL	A-6
		30-60	Very fine sandy loam .....	ML	A-4
Penitente: PE .....	>5	0-60	Very stony loam .....	ML	A-4
Persayo: PH .....	½-1½	0-12	Channery silty clay loam .....	CL or ML	A-7 or A-6
		12	Shale.		
*Pojoaque: PK, Pm, PN .....	>5	0-60	Sandy clay loam and gravelly sandy clay loam.	SC	A-6 or A-2
For Panky part of PK, see Panky series.					
Rough broken land parts of Pm and PK are too variable for valid interpretation.					
Prewitt: PR .....	>5	0-60	Sandy clay loam and clay loam .....	CL	A-6

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water holding capacity	Reaction (1:5 dilution)	Shrink-swell potential	Corrosivity to uncoated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
<i>Percent</i>					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>		
		100	90-100	70-90	0.2-0.63	0.19-0.21	5.6-6.0	Low	High.
15-25	90-100	80-90	55-75	35-50	2.0-6.3	0.10-0.12	6.6-7.8	Low	Low.
40-70	90-100	80-90	65-80	35-50	0.2-0.63	0.08-0.10	7.4-9.0	Low	Moderate.
65-75	90-100	80-90	70-85	50-70	2.0-6.3		8.5-9.0	Low	Low.
0-10	95-100	90-100	60-70	30-40	2.0-6.3	0.11-0.13	5.6-6.0	Low	Low.
0-10	80-90	75-85	65-75	35-45	0.63-2.0	0.11-0.13	5.6-6.0	Low	Low.
		100	90-100	75-95	0.06-0.2	0.14-0.16	5.1-6.0	Moderate	High.
40-70	55-75	50-70	25-40	15-25	2.0-6.3	0.07-0.09	6.1-6.5	Low	Low.
	80-90	75-85	70-80	60-70	0.63-2.0	0.15-0.17	6.6-7.3	Low to moderate	Low.
	30-65	25-60	20-50	15-50	0.63-2.0	0.10-0.12	7.4-8.4	Low	Moderate.
		100	90-100	85-95	<0.06	0.12-0.14	7.9-8.4	High	High.
35-65	75-85	65-75	40-50	30-40	2.0-6.3	0.07-0.09	4.5-5.0	Low	Low.
	80-90	75-85	70-85	50-60	0.2-0.63	0.16-0.18	7.9-9.0	Moderate	Moderate.
		100	85-95	35-50	2.0-6.3	0.13-0.15	7.4-8.4	Low	Low.
		100	70-85	40-50	2.0-6.3	0.13-0.15	6.6-8.4	Low	Low.
		100	90-100	75-85	0.06-2.0	0.16-0.18	7.4-8.4	High	High.
		100	70-80	50-60	0.63-2.0		8.5-9.0	Moderate	Moderate.
	65-80	60-75	55-70	50-65	0.63-2.0	0.12-0.14	7.9-9.0	Low	Low.
40-50	80-90	75-85	70-80	50-70	0.63-2.0	0.10-0.12	7.9-8.4	Low to moderate	Moderate.
0-10	45-55	40-50	35-50	30-40	0.63-2.0	0.08-0.10	7.9-8.4	Low	Moderate.
35-45	40-60	35-55	30-50	20-35	0.63-2.0		7.9-8.4	Low	Moderate.
		100	80-90	50-60	0.63-2.0	0.14-0.16	7.9-8.4	Moderate	Moderate.
		100	85-95	50-65	0.63-2.0	0.15-0.17	7.9-8.4	Low	Low.
40-70	75-95	70-90	65-85	50-70	2.0-6.3	0.08-0.10	4.5-5.5	Low	Low.
	65-75	60-70	55-70	50-65	0.63-2.0	0.14-0.16	7.9-8.4	Moderate	Moderate.
	80-90	70-85	60-75	25-45	0.63-2.0	0.13-0.15	7.4-7.8	Low to moderate	Low.
		100	85-95	60-75	0.63-2.0	0.16-0.18	8.5-9.0	Moderate	Moderate to high.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface in representative profile	Classification		
			USDA texture	Unified	AASHO
<p>*Rednun: RD, RE, RG..... For Pena part of RE, see Pena series; for Travessilla part of RG, see Travessilla series.</p> <p>Riverwash: RH. Too variable for valid interpretation.</p> <p>*Rock outcrop: RK, RL. Too variable for valid interpretation. For Chimayo part of RL, see Chimayo series.</p> <p>Rock slides: RO. Too variable for valid interpretation.</p> <p>Rough broken land: RU. Too variable for valid interpretation.</p>	Feet >5	Inches 0-35 35-60	Clay loam..... Very fine sandy clay loam.....	CL CL or ML	A-6 or A-7 A-6 or A-4
<p>*Santa Fe: SF, Sk, SM..... For La Fonda part of SF, see La Fonda series. Rock outcrop parts of Sk and SM are too variable for valid interpretation.</p>	1/2-1 1/2	0-13 13	Very gravelly clay loam..... Bedrock.	GC	A-2
<p>*Silver: SP, SR..... For Pojoaque part of SP, see Pojoaque series.</p>	>5	0-14 14-45 45-60	Clay (loam surface layer)..... Silty clay loam..... Very fine sandy loam.....	CL CL ML	A-6 or A-7 A-6 A-4
<p>Stony rock land: ST. Too variable for valid interpretation.</p>					
<p>*Supervisor: SU, SV..... Rock outcrop part of SV is too variable for valid interpretation.</p>	1 1/2-2 1/2	0-23 23	Gravelly sandy loam and very gravelly light sandy loam. Bedrock.	SM	A-1
<p>*Tapia: TA..... For Dean part, see Dean series.</p>	>5	0-21 21-60	Clay loam (loam surface layer)..... Gravelly loam.....	CL SM or SC	A-6 A-4
<p>*Travessilla: TB, TR..... For Bernal part of TB, see Bernal series. Rock outcrop part of TR is too variable for valid interpretation.</p>	1/2-1 1/2	0-10	Loam.....	ML	A-4
<p>Tuff rock land: TU. Too variable for valid interpretation.</p>					
<p>Wilcoxson, variant: WC.....</p>	2 1/2-3	0-26 26-31 31	Sandy clay, clay, and gravelly clay. Coarse sandy loam..... Soft bedrock.	CH SM	A-7 A-2
<p>Willard: WL.....</p>	>5	0-10 10-60	Loam..... Clay loam.....	ML or CL CL	A-4 or A-6 A-6
<p>Witt: WN.....</p>	>5	0-36 36-60	Clay loam and sandy clay loam..... Loam.....	CL or ML ML or CL	A-6 A-4
<p>Zuni, variant: ZU.....</p>	1 1/2-3 1/2	0-16 16-20 20	Loam and clay loam..... Clay..... Weathered bedrock.	ML or CL CH	A-4 or A-6 A-7

<sup>1</sup> In mapping unit Aa corrosivity to uncoated steel is high.<sup>2</sup> In mapping unit Bf corrosivity to uncoated steel is high throughout.





TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear

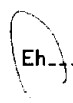
Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Adel: AD-----	Good to poor: 5 to 35 percent slopes.	Unsuitable: fine-grained material.	Fair: A-4 material.	Moderate susceptibility to frost heave.	Moderate permeability; 5 to 35 percent slopes.
Agua Fria: AF-----	Fair to depth of 4 inches; clay loam at depth of 4 to 21 inches.	Good: well-graded sand and gravel below depth of 30 inches; cobblestones in places.	Fair to poor: A-4 and A-6 material to depth of about 30 inches. Good below depth of 30 inches.	Susceptible to frost heave; plastic material.	Rapid permeability below depth of 30 inches; 0 to 5 percent slopes.
Alluvial land, cobbly: AL----	Poor: cobblestones.	Unsuitable: cobbly and fine-grained material.	Good to fair: cobblestones.	Subject to flooding.	Moderate to rapid permeability.
Alluvial land, gravelly: AG---	Poor: gravelly---	Poor: gravelly and fine-grained material.	Good to fair: variable material.	Moderate susceptibility to frost heave.	Moderate to rapid permeability.
Alluvial land, saline: AM----	Poor: saline----	Unsuitable to poor: variable material.	Poor to fair: variable material.	Deep gullies; some flooding.	Slow to rapid permeability.
Ancho: An,Ao-----	Fair: clay loam; soluble salts.	Unsuitable: fine-grained material.	Poor: A-6 and A-7 material.	High susceptibility to frost heave; plastic material.	Moderately slow permeability; 0 to 3 percent slopes.
Apache: AP-----	Poor: stony-----	Unsuitable: fine-grained material; good for crushed rock.	Poor: fractured bedrock at depth of 11 to 20 inches.	Shallow to rock; stones.	Fractured bedrock at depth of 11 to 20 inches.
Badland: BA-----	Poor: slope; sandstone outcrop.	Poor: variable material.	Poor: sandstone outcrop.	Steep and very steep; sandstone bedrock.	Steep and very steep; sandstone bedrock.
Basalt rock land: BD-----	Unsuitable: rock outcrops.	Good for crushed rock.	Poor: rock outcrops.	Exposed bedrock; very steep.	Very steep; very shallow to bedrock.
Bernal----- Mapped only in complex with Travessilla soils.	Poor: bedrock at depth of 8 to 20 inches.	Unsuitable; bedrock at depth of 8 to 20 inches.	Poor: bedrock at depth of 8 to 20 inches.	Shallow to rock; susceptible to frost heave.	Fractured rock at depth of 8 to 20 inches.
Bluewing: Be, Bf, Bg, BH----	Poor: low fertility; gravel.	Poor: gravelly loam layer at depth of 4 to 20 inches; 30 to 50 percent fines.	Good-----	Loose sand hinders hauling.	Rapid permeability; 0 to 5 percent slopes.
*Bobtail: BM, BO----- For Rock outcrop part of BO, see Rock outcrop.	Poor: very strongly acid.	Unsuitable: fine-grained material; stony.	Poor: bedrock at depth of 20 to 40 inches.	Susceptible to frost heave; 20 to 90 percent slopes.	20 to 90 percent slopes; bedrock at depth of 20 to 40 inches.

*engineering properties of the soils*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for in the first column of this table]

Soil features affecting—Continued			Hydro-logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Medium to low shear strength; moderate to low permeability if compacted; high susceptibility to piping.	5 to 35 percent slopes; high available water holding capacity.	Low to moderate shrink-swell potential.	B-----	Moderate to severe: 5 to 35 percent slopes; moderate permeability.	Moderate to severe: 5 to 35 percent slopes.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	Moderately deep rooting depth; high seepage loss in ditches.	High shrink-swell potential.	B-----	Slight: moderately rapid permeability in sub-stratum, rapid below depth of 30 inches; possible ground-water contamination.	Severe: moderately rapid to rapid permeability below depth of 30 inches.
Medium shear strength; moderate permeability if compacted; medium susceptibility to piping.	Cobbly; subject to flooding.	Cobbly; subject to flooding.	B-----	Severe: subject to flooding.	Severe: subject to flooding.
Medium shear strength; moderate permeability if compacted; medium susceptibility to piping.	Gravelly; narrow drainage areas.	Gravelly; subject to flooding.	B-----	Severe: subject to flooding.	Severe: subject to flooding.
Low to medium shear strength; low to moderate permeability if compacted; medium susceptibility to piping.	Saline; deep gullies.	Some flooding-----	B-----	Severe: some flooding.	Severe: some flooding.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	High available water holding capacity; A <sub>o</sub> has high water table and is saline.	Moderate shrink-swell potential.	B in A <sub>n</sub> , C in A <sub>o</sub>	Severe: moderately slow permeability; high water table in A <sub>o</sub> .	Slight to moderate: 0 to 3 percent slopes. Severe in A <sub>o</sub> : high water table.
Fractured bedrock at depth of 11 to 20 inches.	Not suitable-----	Fractured bedrock at depth of 11 to 20 inches.	D-----	Severe: fractured bedrock at depth of 11 to 20 inches.	Severe: fractured bedrock at depth of 11 to 20 inches.
Sandstone bedrock-----	Not suitable-----	Severe: geologic erosion.	D-----	Severe: steep and very steep; sandstone bedrock.	Severe: steep and very steep; sandstone bedrock.
Very shallow to basalt-----	Not suitable-----	Exposed bedrock-----	D-----	Severe: exposed basalt bedrock.	Severe: exposed basalt bedrock.
Bedrock at depth of 8 to 20 inches.	Not suitable-----	Bedrock at depth of 8 to 20 inches.	D-----	Severe: bedrock at depth of 8 to 20 inches.	Severe: bedrock at depth of 8 to 20 inches.
Medium to high shear strength; moderate to low permeability if compacted; medium to low susceptibility to piping.	Low available water holding capacity; rapid water intake rate; B <sub>f</sub> has high water table and is saline.	Low shrink-swell potential.	A; C in B <sub>f</sub>	Slight: possible ground-water contamination. Severe in B <sub>f</sub> : high water table.	Severe: rapid permeability; high water table in B <sub>f</sub> .
Bedrock at depth of 20 to 40 inches.	Not suitable-----	Bedrock at depth of 20 to 40 inches; 20 to 90 percent slopes.	C-----	Severe: 20 to 90 percent slopes; bedrock at depth of 20 to 40 inches.	Severe: 20 to 90 percent slopes; bedrock at depth of 20 to 40 inches.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Borrego: BR.....	Poor: bedrock at depth of 14 to 20 inches.	Unsuitable: bedrock at depth of 14 to 20 inches.	Poor: bedrock at depth of 14 to 20 inches.	Bedrock at depth of 14 to 20 inches; susceptible to frost heave; 10 to 30 percent slopes.	10 to 30 percent slopes; bedrock at depth of 14 to 20 inches.
Calabasas: CA, CB.....	Fair: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor: A-4 or A-6.	High susceptibility to frost heave.	Moderate permeability; 0 to 20 percent slopes.
*Capillo: CC, CE..... For Rock outcrop part of CE, see Rock outcrop.	Poor: gravelly clay loam and clay.	Poor: fine-grained material and gravel.	Poor: A-6 and A-7 material.	High susceptibility to frost heave; plastic; 10 to 70 percent slopes.	10 to 70 percent slopes; slow permeability.
Cerrillos: Cf, CG, Ch.....	Fair: moderate fertility.	Unsuitable: fine-grained material.	Poor: A-6 and A-7 material.	Moderate susceptibility to frost heave; 0 to 10 percent slopes.	Moderate permeability; 0 to 10 percent slopes.
Chimayo: CM.....	Poor: stones; bedrock at depth of 12 to 20 inches.	Unsuitable: stones; bedrock at depth of 12 to 20 inches.	Poor: bedrock at depth of 12 to 20 inches.	30 to 60 percent slopes; bedrock at depth of 12 to 20 inches.	30 to 60 percent slopes; bedrock at depth of 12 to 20 inches.
Clovis: CO.....	Fair: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor: A-4 and A-6 material.	Moderate to high susceptibility to frost heave.	Moderate permeability; 1 to 3 percent slopes.
Cueva: CU.....	Poor: stones; clay content.	Unsuitable: fine-grained material; stones.	Poor: A-7 material; bedrock at depth of 20 to 48 inches.	Moderate susceptibility to frost heave; 20 to 60 percent slopes; bedrock at depth of 20 to 48 inches.	20 to 60 percent slopes; bedrock at depth of 20 to 48 inches.
Cundiyo: CV.....	Poor: very cobbly.	Poor: very cobbly and fine-grained material.	Poor: very cobbly.	Moderate susceptibility to frost heave; 45 to 80 percent slopes.	45 to 80 percent slopes; moderately rapid permeability.
*Dean: DP..... For Pastura part, see Pastura series.	Poor: highly calcareous; caliche gravel.	Fair to good for caliche gravel.	Good to fair: A-2 or A-4 material.	Low susceptibility to frost heave.	Slow permeability; 1 to 9 percent slopes.
*El Rancho: Ec, Ed, Ee, EL..... For Fruitland part of EL, see Fruitland series.	Fair to good: moderate fertility.	Unsuitable: fine-grained material.	Poor: A-6 material.	Moderate susceptibility to frost heave.	Moderate permeability; 0 to 5 percent slopes.
El Rancho, variant:  Eh.....	Fair to good: moderate fertility.	Poor: very gravelly fine sand below depth of 22 inches.	Good below depth of 22 inches: A-1 material.	Moderate susceptibility to frost heave.	Rapid permeability below depth of 22 inches.

*properties of the soils—Continued*

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Bedrock at depth of 14 to 20 inches.	Not suitable .....	Bedrock at depth of 14 to 20 inches; 10 to 30 percent slopes.	D .....	Severe: bedrock at depth of 14 to 20 inches; 10 to 30 percent slopes.	Severe: 10 to 30 percent slopes; bedrock at depth of 14 to 20 inches.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	Moderate permeability; 0 to 20 percent slopes.	Moderate shrink-swell potential; 0 to 20 percent slopes.	B .....	Slight to severe: moderate permeability; 0 to 20 percent slopes.	Moderate to severe: moderate permeability; 0 to 20 percent slopes.
Low shear strength; low permeability if compacted; low susceptibility to piping.	Not suitable .....	High shrink-swell potential; 10 to 70 percent slopes.	C .....	Severe: 10 to 70 percent slopes; slow permeability.	Severe: 10 to 70 percent slopes.
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	Moderate permeability; 0 to 10 percent slopes.	Moderate shrink-swell potential; 0 to 10 percent slopes.	B .....	Slight to moderate: moderate permeability; 0 to 10 percent slopes.	Slight to severe: moderate permeability; 0 to 10 percent slopes.
Bedrock at depth of 12 to 20 inches.	Not suitable .....	Bedrock at depth of 12 to 20 inches; 30 to 60 percent slopes.	D .....	Severe: 30 to 60 percent slopes; bedrock at depth of 12 to 20 inches.	Severe: 30 to 60 percent slopes; bedrock at depth of 12 to 20 inches.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	Moderate permeability; moderate susceptibility to wind erosion when bare.	Moderate shrink-swell potential.	B .....	Slight to moderate: moderate permeability.	Moderate: 1 to 3 percent slopes; moderate permeability.
Bedrock at depth of 20 to 48 inches.	Not suitable .....	High shrink-swell potential; bedrock at depth of 20 to 48 inches; 20 to 60 percent slopes.	D .....	Severe: 20 to 60 percent slopes; bedrock at depth of 20 to 48 inches.	Severe: 20 to 60 percent slopes; bedrock at depth of 20 to 48 inches.
High to medium shear strength; moderate to low permeability if compacted; medium to low susceptibility to piping.	Not suitable .....	Low shrink-swell potential; 45 to 80 percent slopes.	B .....	Severe: 45 to 80 percent slopes.	Severe: 45 to 80 percent slopes.
Medium to high shear strength; moderate to low permeability if compacted; medium to low susceptibility to piping.	Shallow rooting depth; 1 to 9 percent slopes; soft caliche at depth of 6 to 16 inches.	Low shrink-swell potential.	C .....	Severe: slow permeability.	Slight to severe: 1 to 9 percent slopes.
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	High available water holding capacity; moderate permeability; 0 to 5 percent slopes.	Moderate shrink-swell potential.	B .....	Slight to moderate: moderate permeability.	Moderate: moderate permeability; 0 to 5 percent slopes.
Medium shear strength; moderate permeability if compacted; medium to low susceptibility to piping.	Low available water holding capacity; rapid permeability below depth of 22 inches.	Moderate shrink-swell potential in upper 22 inches.	B .....	Slight .....	Severe: rapid permeability below depth of 22 inches.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Encierro: EN.....	Poor: stony; high clay content below depth of 9 inches.	Unsuitable: fine-grained material.	Poor: bedrock at depth of 8 to 20 inches.	Bedrock at depth of 8 to 20 inches; 0 to 20 percent slopes.	Bedrock at depth of 8 to 20 inches; 0 to 20 percent slopes.
Fivemile: Fe, FF.....	Fair to good: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor: A-4 or A-6 material.	High susceptibility to frost heave.	Moderate permeability; 0 to 5 percent slopes.
Fortwingate, variant: FG....	Poor: gravel and cobblestones; 30 to 60 percent slopes.	Poor: fine-grained material and cobblestones below depth of 13 inches.	Good to poor: A-2 and A-6 material; cobbly.	Moderate susceptibility to frost heave; 30 to 60 percent slopes; bedrock at depth of 40 to 55 inches.	30 to 60 percent slopes; bedrock at depth of 40 to 55 inches.
Fruitland: Fn, Fr, Fs, Ft....	Fair: low fertility.	Poor: fine-grained material.	Fair: dominantly A-4 material.	Erodible when exposed on embankments.	Moderately rapid permeability; 0 to 5 percent slopes.
Galisteo: GG.....	Poor: strongly alkaline; high clay content below depth of 6 inches.	Unsuitable: fine-grained material.	Poor: A-7 material.	Moderate susceptibility to frost heave; highly erodible when exposed on embankments.	Slow permeability; 0 to 3 percent slopes.
Guaje: GL.....	Poor: very gravelly.	Good: pumice gravel.	Good.....	10 to 30 percent slopes; erodible when exposed on embankments.	10 to 30 percent slopes; rapid permeability.
Hagerman: HA.....	Poor: bedrock at depth of 20 to 40 inches.	Unsuitable: fine-grained material.	Poor: A-6 material; bedrock at depth of 20 to 40 inches.	Moderate susceptibility to frost heave; bedrock at depth of 20 to 40 inches.	Fractured bedrock at depth of 20 to 40 inches; 0 to 5 percent slopes.
*Harvey: HC, HD, HP, HR.. For Dean part of HD, see Dean series; for Penistaja part of HP, see Penistaja series; for Cerrillos part of HR, see Cerrillos series.	Poor: low to moderate fertility; erodible; strongly calcareous.	Unsuitable: fine-grained material.	Fair to poor: A-4 or A-6 material.	Moderate to high susceptibility to frost heave; highly erodible when exposed on embankments.	Moderate permeability; 1 to 9 percent slopes.
La Brier: LB.....	Fair: high clay content, but high fertility.	Unsuitable: fine-grained material.	Poor: A-6 or A-7 material.	Subject to flooding; high susceptibility to frost heave.	Slow permeability; 0 to 1 percent slopes.



*properties of the soils—Continued*

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Bedrock at depth of 8 to 20 inches.	Not suitable-----	High shrink-swell potential; bedrock at depth of 8 to 20 inches.	D-----	Severe: bedrock at depth of 8 to 20 inches; 0 to 20 percent slopes.	Severe: bedrock at depth of 8 to 20 inches; 0 to 20 percent slopes.
Medium to low shear strength; moderate to low permeability if compacted; high susceptibility to piping.	High available water holding capacity; moderate permeability; 0 to 5 percent slopes.	Moderate-shrink-swell potential.	B-----	Slight to moderate: moderate permeability.	Moderate: moderate permeability; 0 to 5 percent slopes.
Medium shear strength; low permeability if compacted; medium resistance to piping; bedrock at depth of 40 to 55 inches.	Not suitable-----	Low shrink-swell potential; bedrock at depth of 40 to 55 inches; 30 to 60 percent slopes.	B-----	Severe: 30 to 60 percent slopes; bedrock at depth of 40 to 55 inches.	Severe: 30 to 60 percent slopes; bedrock at depth of 40 to 55 inches.
Medium shear strength; moderate to low permeability if compacted; medium to high susceptibility to piping.	Susceptible to soil blowing; moderate available water holding capacity; Fs is saline and has high water table.	Low shrink-swell potential.	B; C in Fs.	Slight. Severe in Fs: high water table.	Severe: moderately rapid permeability; high water table in Fs.
Low shear strength; low permeability if compacted; medium susceptibility to piping.	High available water holding capacity; susceptible to salt accumulation; slow permeability; gullied.	High shrink-swell potential.	C-----	Severe: slow permeability.	Slight to moderate: 0 to 3 percent slopes.
Medium shear strength; moderate permeability if compacted; medium to high susceptibility to piping.	Low available water holding capacity; 10 to 30 percent slopes.	Low shrink-swell potential; pumice at depth of 11 to 20 inches.	A-----	Moderate to severe: 10 to 30 percent slopes.	Severe: 10 to 30 percent slopes; rapid permeability.
Bedrock at depth of 20 to 40 inches.	Rooting depth 20 to 40 inches; moderate available water holding capacity.	Moderate shrink-swell potential; bedrock at depth of 20 to 40 inches.	C-----	Severe: bedrock at depth of 20 to 40 inches.	Severe: bedrock at depth of 20 to 40 inches.
Medium to low shear strength; moderate to low permeability if compacted; medium susceptibility to piping.	Susceptible to soil blowing; high lime layer at depth of 1 to 2 feet.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability; 1 to 9 percent slopes.	Moderate to severe: moderate permeability; 1 to 9 percent slopes.
Medium to low shear strength, low permeability; low to medium susceptibility to piping.	Slow permeability; subject to flooding.	Moderate shrink-swell potential; subject to flooding.	C-----	Severe: subject to flooding; slow permeability.	Severe: subject to flooding.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
La Fonda: Lf-----	Fair: moderate fertility.	Unsuitable: fine-grained material.	Fair: low to moderate shrink-swell potential; dominantly A-4 material if mixed.	Moderate susceptibility to frost heave.	Moderate permeability; 3 to 10 percent slopes.
*Laporte: Lg, LH----- For Rock outcrop parts, see Rock outcrop.	Poor: about 15 percent cobblestones and stones; bedrock at depth of 8 to 20 inches.	Unsuitable: fine-grained material, cobblestones and stones; source of limestone for crushing; bedrock at depth of 8 to 20 inches.	Poor: bedrock at depth of 8 to 20 inches.	Bedrock at depth of 8 to 20 inches; 5 to 25 percent slopes.	Fractured bedrock at depth of 8 to 20 inches; 5 to 25 percent slopes.
Las Lucas: LL-----	Fair: moderate fertility; clay loam.	Unsuitable: fine-grained material.	Poor: A-6 material.	High susceptibility to frost heave; unstable material.	Slow permeability; shale at depth of 40 to 60 inches.
*Los Alamos: LS----- For Silver part, see Silver series.	Fair: moderate fertility; gravel below depth of 25 inches.	Unsuitable: fine-grained material; source of pumice below depth of 40 inches.	Fair: dominantly A-4 material.	Susceptible to frost heave; highly erodible substratum when exposed on embankments.	Moderate permeability; 0 to 10 percent slopes.
Lunch, variant: LU-----	Poor: poorly drained.	Unsuitable: fine-grained material.	Poor: water at or near surface; high organic-matter content.	High organic-matter content; wet seepy areas.	Moderately slow permeability; high water table.
Majada: MA-----	Poor: stony and cobbly.	Poor: fine-grained material; cobblestones and stones.	Fair to poor: stones; A-4 and A-6 material.	Stones hinder hauling and grading operations; 20 to 50 percent slopes.	Moderate permeability; 20 to 50 percent slopes.
McVickers, variant: MC-----	Fair: 5 percent cobblestones; medium acid.	Poor: fine-grained material.	Poor: A-6 and A-7 material.	Susceptible to frost heave; plastic material.	Slow permeability; 5 to 20 percent slopes.
*Mirabal: MD, ME, MF----- For Rock outcrop part of MF, see Rock outcrop.	Poor: very stony; bedrock at depth of 20 to 30 inches.	Unsuitable: bedrock at depth of 20 to 30 inches.	Poor: bedrock at depth of 20 to 30 inches.	Bedrock at depth of 20 to 30 inches; stony; 5 to 100 percent slopes.	Bedrock at depth of 20 to 30 inches; 5 to 100 percent slopes.
Montoso: MG, MH-----	Poor: gravelly---	Unsuitable for sand: fine-grained material. Good source of cinders below depth of 18 inches.	Good for cinders below depth of 12 to 32 inches.	5 to 60 percent slopes; cinders at depth of 12 to 32 inches.	Moderate permeability; 5 to 60 percent slopes.

*properties of the soils—Continued*

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	High available water holding capacity; 3 to 10 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability; 3 to 10 percent slopes.	Moderate to severe: 3 to 10 percent slopes; moderate permeability.
Bedrock at depth of 8 to 20 inches.	Not suitable-----	Low shrink-swell potential; bedrock at depth of 8 to 20 inches.	C-----	Severe: bedrock at depth of 8 to 20 inches.	Severe: bedrock at depth of 8 to 20 inches.
Medium to low shear strength; low permeability if compacted; medium susceptibility to piping.	High available water holding capacity; susceptible to salt accumulation; 1 to 9 percent slopes.	Moderate shrink-swell potential; shale at depth of 40 to 60 inches.	C-----	Severe: slow permeability.	Moderate to severe: shale at depth of 40 to 60 inches; 1 to 9 percent slopes.
Medium to low shear strength; moderate permeability if compacted; medium susceptibility to piping.	Moderate available water holding capacity; 0 to 10 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: 0 to 10 percent slopes.	Severe: moderately rapid permeability below depth of 25 inches; 1 to 10 percent slopes.
Medium to low shear strength; low permeability if compacted; medium to high susceptibility to piping.	Not suitable-----	Water table at or near surface; poor drainage.	D-----	Severe: water table at or near surface.	Severe: high water table.
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	Not suitable-----	Low shrink-swell potential.	B-----	Severe: 20 to 50 percent slopes.	Severe: 20 to 50 percent slopes.
Low shear strength; low permeability if compacted; low susceptibility to piping.	Not suitable-----	Moderate shrink-swell potential.	C-----	Severe: slow permeability; 5 to 20 percent slopes.	Moderate to severe: 5 to 20 percent slopes.
Bedrock at depth of 20 to 30 inches.	Not suitable-----	Bedrock at depth of 20 to 30 inches; low shrink-swell potential; 5 to 100 percent slopes.	C-----	Severe: bedrock at depth of 20 to 30 inches; 5 to 100 percent slopes.	Severe: bedrock at depth of 20 to 30 inches; 5 to 100 percent slopes.
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	Not suitable-----	Low shrink-swell potential; 5 to 60 percent slopes.	B-----	Moderate to severe: 5 to 60 percent slopes.	Severe: 5 to 60 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Moriarty: MO-----	Poor: high clay content; highly erodible.	Unsuitable: fine-grained material.	Poor: A-7 material.	Moderate susceptibility to frost heave; plastic material.	0 to 5 percent slopes; very slow permeability.
*Nambe: NA, NB, NE, NM, NR. For Rock outcrop parts of NM and NR, see Rock outcrop.	Poor: stony; very strongly acid; rock outcrops in NM and NR.	Poor: fine-grained material and stones.	Poor: 20 to 100 percent slopes; stony; rock outcrops in NM and NR.	20 to 100 percent slopes; stones and rock outcrops.	20 to 100 percent slopes; moderately rapid permeability.
Ortiz: OG-----	Poor: 15 to 20 percent gravel; bedrock at depth of 20 to 40 inches.	Unsuitable: 60 to 70 percent fine-grained material.	Poor: bedrock at depth of 20 to 40 inches.	5 to 40 percent slopes; moderate susceptibility to frost heave; bedrock at depth of 20 to 40 inches.	Bedrock at depth of 20 to 40 inches; 5 to 40 percent slopes.
*Otero: OP----- For Palma part, see Palma series.	Fair to good: low fertility.	Poor for sand: sandy loam. Unsuitable for gravel: no gravel.	Fair: A-4 material.	Highly erodible when exposed on embankments; 1 to 9 percent slopes.	Moderately rapid permeability; 1 to 9 percent slopes.
Palma-----	Fair to good: low fertility.	Poor for sand: fine sandy loam. Unsuitable for gravel: no gravel.	Fair: A-4 material.	Highly erodible when exposed on embankments; 1 to 9 percent slopes.	Moderately rapid permeability; 1 to 9 percent slopes.
Panky: Pa, PB-----	Fair: moderate fertility; clay loam.	Unsuitable: fine-grained material.	Fair to poor: A-4 and A-6 material.	Moderate to high susceptibility to frost heave; erodible substratum.	Slow permeability; 0 to 9 percent slopes.
Pastura----- Mapped only in complex with Dean soils.	Poor: gravelly; indurated caliche at depth of 8 to 20 inches.	Good for caliche gravel.	Poor: indurated caliche at depth of 8 to 20 inches.	Indurated caliche at depth of 8 to 20 inches; highly erodible when exposed on embankments.	Indurated caliche at depth of 8 to 20 inches; 1 to 9 percent slopes.
Pena: PC-----	Poor: gravel, cobblestones, and stones.	Fair source of gravel: some cobblestones and stones.	Fair to good: stones; A-2 and A-4 material.	High susceptibility to frost heave; gravel, cobblestones, and stones; 1 to 25 percent slopes.	Moderate permeability; 1 to 25 percent slopes.
Penistaja: PD-----	Fair to good: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor: A-4 and A-6 material.	Moderate susceptibility to frost heave.	Moderate permeability; 0 to 5 percent slopes.
Penitente: PE-----	Poor: cobblestones.	Unsuitable: fine-grained material and cobblestones.	Fair: A-4 material.	0 to 30 percent slopes; cobbly.	Moderately rapid permeability; 0 to 30 percent slopes.

*properties of the soils—Continued*

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Low shear strength; low permeability if compacted; medium susceptibility to piping.	High available water holding capacity; slow intake rate; severe hazard of erosion.	High shrink-swell potential.	D-----	Severe: very slow permeability.	Slight to moderate: slope; subject to flooding.
Medium shear strength; moderate permeability if compacted; medium susceptibility to piping.	Not suitable-----	Low shrink-swell potential; 20 to 100 percent slopes.	B-----	Severe: 20 to 100 percent slopes.	Severe: 20 to 100 percent slopes.
Bedrock at depth of 20 to 40 inches.	Not suitable-----	Moderate shrink-swell potential; shale at depth of 20 to 40 inches.	C-----	Severe: bedrock at depth of 20 to 40 inches; moderately slow permeability.	Severe: 5 to 40 percent slopes; bedrock at depth of 20 to 40 inches.
Medium shear strength; moderate to low permeability if compacted; medium to high susceptibility to piping.	Severe: susceptibility to soil blowing; moderately rapid permeability; 1 to 9 percent slopes.	Low shrink-swell potential.	B-----	Slight to moderate: 1 to 9 percent slopes.	Severe: moderately rapid permeability.
Medium shear strength; moderate to low permeability if compacted; medium to high susceptibility to piping.	Severe: susceptibility to soil blowing; moderately rapid permeability; 1 to 9 percent slopes.	Low shrink-swell potential.	B-----	Slight to moderate: 1 to 9 percent slopes.	Severe: moderately rapid permeability.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	0 to 9 percent slopes; low available water holding capacity.	High shrink-swell potential.	C-----	Severe: slow permeability.	Slight to severe: 0 to 9 percent slopes.
Indurated caliche at depth of 8 to 20 inches.	Not suitable-----	Low shrink-swell potential; indurated caliche at depth of 8 to 20 inches.	D-----	Severe: indurated caliche at depth of 8 to 20 inches.	Severe: indurated caliche at depth of 8 to 20 inches.
Medium to high shear strength; moderate to low permeability if compacted; medium to low susceptibility to piping.	Not suitable-----	Low to moderate shrink-swell potential; 1 to 25 percent slopes.	B-----	Slight to severe: 1 to 25 percent slopes.	Moderate to severe: 1 to 25 percent slopes; moderate permeability.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	High available water holding capacity; moderate permeability; 0 to 5 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Medium shear strength; moderate permeability if compacted; medium susceptibility to piping.	Not suitable-----	Low shrink-swell potential.	B-----	Slight to severe: 0 to 30 percent slopes.	Severe: moderately rapid permeability; 0 to 30 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Persayo: PH-----	Poor: channery; bedrock at depth of 6 to 16 inches.	Unsuitable: bedrock at depth of 6 to 16 inches.	Poor: bedrock at depth of 6 to 16 inches.	Bedrock at depth of 6 to 16 inches; highly erodible when exposed on embankments.	Bedrock at depth of 6 to 16 inches; 3 to 25 percent slopes.
*Pojoaque: PK, Pm, PN. For Panky part of PK, see Panky series; for Rough broken land parts of Pm and PN, see Rough broken land.	Poor: 5 to 10 percent gravel; low fertility; 5 to 25 percent slopes.	Poor: fine-grained material; pockets of clean sand in places.	Fair: A-4 material if mixed.	Moderate susceptibility to frost heave.	Moderate permeability; 5 to 25 percent slopes.
Prewitt: PR-----	Fair: moderate fertility; highly erodible.	Unsuitable: fine-grained material.	Poor: A-6 material.	Moderate to high susceptibility to frost heave; erodible when exposed on embankments.	Moderate permeability; 0 to 5 percent slopes.
*Rednun: RD, RE, RG----- For Pena part of RE, see Pena series; for Travessilla part of RG, see Travessilla series.	Fair: moderate fertility; clay loam.	Unsuitable: fine-grained material.	Poor: A-6 material.	Susceptible to frost heave; plastic material.	Slow permeability; 1 to 9 percent slopes.
Riverwash: RH-----	Poor: sandy; low fertility.	Good source of sand; gravel pockets.	Good if soil binder is added.	Subject to flooding.	Subject to flooding.
*Rock outcrop: RK, RL----- For Chimayo part of RL, see Chimayo series.	Unsuitable: rock outcrop.	Unsuitable: rock outcrop.	Poor: rock outcrop; 45 to 100 percent slopes.	Exposed bedrock; 45 to 100 percent slopes.	Rock outcrop-----
Rock slides: RO-----	Unsuitable: rock slides.	Unsuitable: rock slides.	Poor: rock slides; steep and very steep.	Steep and very steep; rock slides.	Rock slides; steep and very steep.
Rough broken land: RU-----	Poor: slope; low fertility.	Fair: some strata of fine-grained material; some cobblestones and stones.	Poor: very steep; rock outcrops.	Very steep; stones.	Very steep; severe hazard of erosion; very shallow soils; rock outcrops.
*Santa Fe: SF, Sk, SM----- For La Fonda part of SF, see La Fonda series; for Rock outcrop parts of Sk and SM, see Rock outcrop.	Poor: gravel; bedrock at depth of 6 to 17 inches.	Unsuitable: bedrock at depth of 6 to 17 inches.	Poor stones; bedrock at depth of 6 to 17 inches.	Bedrock at depth of 6 to 17 inches; slope.	Bedrock at depth of 6 to 17 inches; 5 to 25 percent slopes.
*Silver: SP, SR----- For Pojoaque part of SP, see Pojoaque series.	Fair to poor: clay.	Unsuitable: fine-grained material.	Poor: A-6 and A-7 material.	Susceptible to frost heave; plastic material.	Slow permeability; 0 to 10 percent slopes.
Stony rock land: ST-----	Unsuitable: stony; rocky.	Poor: source of cobblestones and stones.	Fair: cobblestones and stones.	20 to 100 percent slopes; stones hinder hauling and grading operations.	Stony rock land; 20 to 100 percent slopes.



*properties of the soils*—Continued

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Bedrock at depth of 6 to 16 inches.	Not suitable-----	Moderate shrink-swell potential; bedrock at depth of 6 to 16 inches.	D-----	Severe: bedrock at depth of 6 to 16 inches.	Severe: bedrock at depth of 6 to 16 inches.
Medium shear strength; low permeability if compacted; medium to low susceptibility to piping.	High available water holding capacity; 5 to 25 percent slopes.	Low to moderate shrink-swell potential.	B-----	Slight to severe: 5 to 25 percent slopes.	Moderate to severe: 5 to 25 percent slopes; moderate permeability.
Medium to low shear strength; low permeability if compacted; medium to low susceptibility to piping.	High available water holding capacity; 0 to 5 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability.	Moderate: moderate permeability; 0 to 5 percent slopes.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	High available water holding capacity; 1 to 9 percent slopes.	High shrink-swell potential.	C-----	Severe: slow permeability.	Slight to severe: 1 to 9 percent slopes.
Medium shear strength; moderate to high permeability if compacted; medium to high susceptibility to piping.	Not suitable-----	Subject to flooding---	A-----	Severe: subject to flooding.	Severe: subject to flooding.
Rock outcrop-----	Not suitable-----	Exposed bedrock; 45 to 100 percent slopes.	D-----	Severe: exposed bedrock.	Severe: exposed bedrock.
Rock slides-----	Not suitable-----	Rock slides; steep and very steep.	D-----	Severe: rock slides; steep and very steep.	Severe: rock slides; steep and very steep.
Very shallow soils on dissected ridges and mesas; rock outcrops.	Not suitable-----	Variable material----	D-----	Severe: very steep--	Severe: very steep.
Bedrock at depth of 6 to 17 inches.	Not suitable-----	Low shrink-swell potential; bedrock at depth of 6 to 17 inches.	D-----	Severe: bedrock at depth of 6 to 17 inches.	Severe: bedrock at depth of 6 to 17 inches.
Medium to low shear strength; low permeability if compacted; low to medium susceptibility to piping.	High available water holding capacity; slow permeability in subsoil; 0 to 10 percent slopes.	High shrink-swell potential in subsoil.	C-----	Severe: slow permeability in subsoil.	Slight to severe: 0 to 10 percent slopes.
Stony rock land-----	Not suitable-----	Stony; rocky; 20 to 100 percent slopes.	D-----	Severe: 20 to 100 percent slopes.	Severe: 20 to 100 percent slopes.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Highway location	Farm ponds
					Reservoir area
*Supervisor: SU, SV----- For Rock outcrop part of SV, see Rock outcrop.	Poor: stones; bedrock at depth of 20 to 30 inches.	Poor: bedrock at depth of 20 to 30 inches.	Poor: bedrock at depth of 20 to 30 inches.	Bedrock at depth of 20 to 30 inches; 15 to 100 percent slopes.	Bedrock at depth of 20 to 30 inches; 15 to 100 percent slopes.
*Tapia: TA----- For Dean part, see Dean series.	Fair: moderate fertility; caliche gravel below depth of 21 inches.	Good source of caliche for crushing below depth of 21 inches.	Fair: dominantly A-4 material.	Moderate susceptibility to frost heave.	Moderate permeability; 1 to 5 percent slopes.
*Travessilla: TB, TR----- For Bernal part of TB, see Bernal series; for Rock outcrop part, see Rock outcrop.	Poor: bedrock at depth of 6 to 18 inches.	Unsuitable: bedrock at depth of 6 to 18 inches.	Poor: bedrock at depth of 6 to 18 inches.	1 to 25 percent slopes; bedrock at depth of 6 to 18 inches.	Bedrock at depth of 6 to 18 inches; 1 to 25 percent slopes.
Tuff rock land: TU-----	Unsuitable: tuff rock outcrops.	Poor: tuff rock outcrops.	Poor: tuff rock outcrops.	Very steep; exposed tuff rock.	Tuff rock outcrops; very steep.
Wilcoxson, variant: WC-----	Poor: clay; bedrock at depth of 30 to 36 inches.	Unsuitable: fine-grained material; bedrock at depth of 30 to 36 inches.	Poor: bedrock at depth of 30 to 36 inches.	Bedrock at depth of 30 to 36 inches; 15 to 40 percent slopes.	15 to 40 percent slopes; slow permeability.
Willard: WL-----	Fair: moderate fertility.	Unsuitable: fine-grained material.	Poor: dominantly A-6 material.	High susceptibility to frost heave; substratum erodible when exposed.	Moderately slow permeability; 0 to 3 percent slopes.
Witt: WN-----	Fair: moderate fertility; clay loam.	Unsuitable: fine-grained material.	Fair to poor: A-4 and A-6 material.	High susceptibility to frost heave; substratum erodible when exposed.	Moderate permeability; 0 to 5 percent slopes.
Zuni, variant: ZU-----	Poor: 10 to 40 percent slopes; bedrock at depth of 20 to 40 inches.	Unsuitable: bedrock at depth of 20 to 40 inches.	Poor: bedrock at depth of 20 to 40 inches.	10 to 40 percent slopes; moderate to high susceptibility to frost heave; bedrock at depth of 20 to 40 inches.	Bedrock at depth of 20 to 40 inches; 10 to 40 percent slopes.

*properties of the soils—Continued*

Soil features affecting—Continued			Hydro- logic soil group	Soil limitations for sewage disposal	
Farm ponds	Irrigation	Foundations for low buildings		Septic tank filter fields	Sewage lagoons
Embankment					
Bedrock at depth of 20 to 30 inches.	Not suitable-----	Bedrock at depth of 20 to 30 inches; 15 to 100 percent slopes.	C-----	Severe: 15 to 100 percent slopes; bedrock at depth of 20 to 30 inches.	Severe: 15 to 100 percent slopes; bedrock at depth of 20 to 30 inches.
Medium shear strength; moderate to low permeability if compacted; medium susceptibility to piping.	Moderate permeability; 1 to 5 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability.	Moderate: moderate permeability; 1 to 5 percent slopes.
Bedrock at depth of 6 to 18 inches.	Not suitable-----	Low to moderate shrink-swell potential; bedrock at depth of 6 to 18 inches.	D-----	Severe: bedrock at depth of 6 to 18 inches; 1 to 25 percent slopes.	Severe: bedrock at depth of 6 to 18 inches; 1 to 25 percent slopes.
Tuff rock outcrops-----	Not suitable-----	Exposed tuff rock; very steep.	D-----	Severe: very steep; exposed bedrock.	Severe: very steep; exposed bedrock.
Bedrock at depth of 30 to 36 inches.	15 to 40 percent slopes; bedrock at depth of 30 to 36 inches.	High shrink-swell potential; bedrock at depth of 30 to 36 inches.	C-----	Severe: 15 to 40 percent slopes; slow permeability; bedrock at depth of 30 to 36 inches.	Severe: 15 to 40 percent slopes; bedrock at depth of 30 to 36 inches.
Low shear strength; low permeability if compacted; medium susceptibility to piping.	Susceptible to salt accumulation; low available water holding capacity; moderately slow permeability.	Moderate shrink-swell potential.	B-----	Severe: moderately slow permeability.	Slight to moderate: 0 to 3 percent slopes.
Low shear strength; low permeability if compacted; medium susceptibility to piping.	Moderate permeability; 0 to 5 percent slopes.	Moderate shrink-swell potential.	B-----	Slight to moderate: moderate permeability.	Moderate: moderate permeability; 0 to 5 percent slopes.
Bedrock at depth of 20 to 40 inches.	Not suitable-----	High shrink-swell potential; bedrock at depth of 20 to 40 inches.	C-----	Severe: bedrock at depth of 20 to 40 inches; 10 to 40 percent slopes.	Severe: 10 to 40 percent slopes; bedrock at depth of 20 to 40 inches.

TABLE 7.—*Engineering*

[Tests performed by New Mexico State Highway Department, Materials and Testing Division, in accordance

Soil name and location	New Mexico State highway report No.	Depth	Mechanical analysis <sup>1</sup>			
			Percentage passing sieve—			
			2 in.	1 in.	¾ in.	½ in.
		<i>Inches</i>				
Calabazas loam: About 0.25 mile west of road south from Tetilla Trick Tank, about 2 miles south of Tetilla Peak, La Majada Grant. (Modal)	65-56	0-11	-----	-----	-----	-----
	65-57	11-21	-----	-----	-----	-----
	65-58	44-53	-----	-----	-----	-----
Las Lucas loam: About 4.5 miles south of Galisteo on New Mexico Highway No. 41, 25 feet east of highway, unsectionized San Cristoval Grant. (Modal)	65-84	0-3	-----	-----	-----	-----
	65-85	3-9	-----	-----	-----	-----
	65-86	9-14	-----	-----	-----	-----
Mirabal stony loam: About 1 mile north of Hyde State Park, NE¼SE¼ sec. 25, T. 18 N., R. 10 E. (Modal)	65-70	0-5	-----	100	99	97
	65-71	5-9	100	84	80	77
Montoso gravelly silt loam: Caja del Rio Grant; along road to tank 31, about 1.1 miles north- east of Cerro Micho. (Modal)	65-65	0-3	100	96	92	88
	65-66	6-12	100	88	84	79
Moriarty silty clay: About 0.25 miles west of the quarter corner sec. 28 and 33, T. 15 N., R. 11 E. (Modal)	65-79	0-7	-----	-----	-----	-----
	65-80	7-19	-----	-----	-----	-----
Nambe gravelly loam: About 1.4 miles southwest of Santa Fe ski bowl, NE¼ sec. 20, T. 18 N., R. 11 E. (Modal)	65-72	2-8	100	96	93	88
	65-73	8-20	-----	100	97	95
Panky fine sandy loam: About 200 feet south of road; NE¼SW¼ sec. 31, T. 17 N., R. 9 E. (Modal)	65-75	4-11	-----	-----	-----	-----
	65-76	20-40	-----	-----	-----	-----
Rednun loam: About 1.5 miles northwest of Padre Spring on Glorieta Mesa, NE¼ sec. 20, T. 15 N., R. 11 E. (Modal)	65-81	0-3	-----	-----	-----	-----
	65-82	17-36	-----	-----	-----	-----
	65-83	47-80	-----	-----	-----	-----
Silver loam: Caja del Rio Grant; on east side of road, about 2 miles north- east of Tetilla Peak. (Modal)	65-59	3-14	-----	-----	-----	-----
	65-60	14-30	-----	-----	-----	-----

<sup>1</sup> Analysis according to AASHTO Designation: T 88-57 (1). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soils.

*test data*

with standard procedures of the American Association of State Highway Officials (AASHO) (1)]

Mechanical analysis <sup>1</sup> —Continued					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued							AASHO <sup>2</sup>	Unified <sup>3</sup>
¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
					<i>Percent</i>			
		100	98	80	27	12	A-6(9)	CL
		100	98	85	33	12	A-6(9)	CL
		100	87	67	30	6	A-4(6)	ML
		100	66	97	27	8	A-4(6)	CL
		100	66	97	31	8	A-4(6)	ML-CL
		100	76	98	36	14	A-6(10)	CL
95	86	66	37	25	<sup>4</sup> S	<sup>5</sup> NP	A-1-b(0)	SM
74	66	50	28	20	S	NP	A-1-b(0)	SM
87	83	81	75	70	32	9	A-4(7)	ML-CL
75	62	57	51	46	44	20	A-7-6(6)	SC
		100	97	91	40	14	A-6(10)	ML
		100	94	87	42	20	A-7-6(12)	CL
84	76	63	46	38	33	8	A-4(1)	SM
92	84	72	49	40	38	10	A-4(1)	SM
		100	93	80	40	17	A-6(11)	CL
		100	76	54	32	9	A-4(4)	ML-CL
		100	99	89	S	NP	A-4(8)	ML
		100	98	85	31	11	A-6(8)	CL
		100	98	78	23	7	A-4(8)	ML-CL
		100	98	90	38	18	A-6(11)	CL
		100	98	89	37	17	A-6(11)	CL

<sup>2</sup> Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (PT. 1, RD 8): the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-149.

<sup>3</sup> Based on the Unified Soil Classification System.

<sup>4</sup> S=Sandy.

<sup>5</sup> NP=Nonplastic.

La Brier loam (LB); portions of Adel loam, 5 to 35 percent slopes (AD); Alluvial land, gravelly (AG); Alluvial land, cobbly (AL); Bluewing gravelly sandy loam (Bg, BH); and Fivemile loam (Fe, FF) are subject to occasional floods in summer when thunderstorm activity is greatest. Lunch peat, shallow variant (LU), has a water table at or near the surface all year. Ancho clay loam, saline (Ao); El Rancho sandy clay loam, 1 to 3 percent slopes (Ed); Fruitland sandy loam, saline, 0 to 1 percent slopes (Fs); and Bluewing loamy fine sand, saline (Bf) have a seasonal water table that ranges from near the surface to more than 3 feet below it. These soils and Alluvial land, saline (AM) have a fluctuating water table and generally are slightly to moderately saline. They have an electrical conductivity ( $E_c \times 10^3$ ) of 4 to 15 millimhos per centimeter at 25° C. As water nears the surface, it evaporates, thus increasing the salt concentration until the water table lowers and the salts are leached down again. All other soils in the area are nonsaline and have an electrical conductivity of 0 to 1 millimhos per centimeter at 25° C.

### Engineering interpretations

Table 6 contains selected information useful to engineers and others who plan to use soil material in constructing highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but very important desirable features also may be listed. The ratings and other interpretations in this table are based on the estimated engineering properties shown in table 5; on available test data, including those in table 7; and on field experience. Although the information is intended to apply only to soil depths indicated in table 5, it is reasonably reliable to depths of about 6 feet for most soils, and to several more feet for some.

*Topsoil* is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, that is used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for this use.

*Sand and gravel* ratings are based on the probability that delineated areas of the soil contain deposits of sand and gravel. The ratings do not indicate the quality or size of the deposits.

*Road fill* is material used to build embankments. The ratings indicate how well a soil material will perform if moved from borrow areas for this use.

*Highway location* is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features rated, favorable as well as unfavorable, are the main ones that affect geographic location of highways.

*Farm pond reservoir areas* are affected mainly by seepage, or loss of water. The soil features rated are those that influence seepage.

*Farm pond embankments* serve as dams. The soil features of the horizons below the surface layer are the ones important to the use of soils for embankment construction.

*Irrigation suitability* is influenced by permeability, available water holding capacity, hazard of erosion, slope, salinity, coarse fragments, and depth to bedrock.

*Foundations for low buildings* are affected mainly by features of the undisturbed soil that influence a soil's capacity to support low buildings that have normal foundation loads.

*Hydrologic soil group* ratings apply to the entire soil

profile. Soils are placed in four groups on the basis of their water intake rate at the end of a long storm, after prior wetting and swelling and without the protection of vegetation. Soils in group A are deep, rapidly permeable sands that contain little silt and clay. They absorb the most rain and have the least runoff. Soils in group B are deep and have a permeability of moderately rapid to moderately slow. They absorb more water than average, even when they are thoroughly wet. Soils in group C are shallow to moderately deep. Permeability is slow. Soils in group D are mostly clays that increase greatly in volume when they absorb water, but in places they are shallow soils that have very slowly permeable layers near the surface. The soils in this group absorb the least rain and have the most runoff.

*Septic tank filter fields* are affected mainly by permeability, slope, location of the water table, and susceptibility to flooding. The degree of limitations and principal reasons for assigning moderate or severe limitations are given.

*Sewage lagoons* are influenced chiefly by such soil features as permeability, location of the water table, and slope. The degree of limitation and the principal reasons for assigning moderate or severe limitations are given.

### Engineering test data

Table 7 contains the results of engineering tests performed by the New Mexico State Highway Department on several important soils in the Santa Fe Area. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

*Mechanical analyses* show the percentages, by weight, of soil particles that would pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve, but silt and clay do. Percentage fractions smaller than openings in the No. 200 sieve were determined by the hydrometer method rather than the pipette method most soil scientists use in determining the clay in soil samples.

*Liquid limit and plasticity index* indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic. The liquid limit is the moisture content at which the material changes from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

The AASHTO and Unified classifications have been explained earlier in the engineering section.

### Use of the Soils for Recreation

The Santa Fe Area is easily accessible, and it offers many opportunities for outdoor recreation. Many thousands of visits are made to the Area each year by sightseers, picnickers, campers, hunters, hikers, horseback



riders, and others in search of recreation. Santa Cruz Reservoir, which is fished heavily during all parts of the season, is a major attraction at the lower elevation. Several small mountain lakes furnish fishing during the summer months. Hyde State Park is a favorite camping, picnicking, and hiking area. The Santa Fe Ski Basin hosts thousands of skiers each season.

In table 8 the soils of the Area are rated as to their limitations on the basis of characteristics significant in the design and development of recreational facilities. The main characteristics considered are wetness, flooding, permeability, slope, surface texture, depth to bedrock, and coarse fragments.

The ratings are not intended to be recommendations of specific locations for recreational developments. They are given as guides to the nature of a soil and terrain and its limitations for recreational activities. Other factors used in selecting sites include land ownership, land value, esthetic value, and accessibility. In some circumstances, soil limitations can be modified or removed so that the soil can be used safely for the intended purpose. For this reason some kinds of soil rated as severe can be used as intended. Table 8 does not include interpretations for cottage foundations and cottage sites. For such interpretations refer to "Foundations for low buildings" in the Engineering subsection.

TABLE 8.—*Limitations of the soils for use in recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
Adel: AD-----	Moderate where slopes are 5 to 8 percent. Severe where slopes are more than 8 percent.	Slight where slopes are 5 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are 5 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are 5 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Agua Fria: AF-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
Alluvial land, cobbly: AL.	Severe: coarse fragments on surface; slopes of 10 percent in places.	Severe: coarse fragments on surface; subject to flooding during season of use.	Moderate: subject to flooding for short periods during season of use.	Moderate: subject to flooding two or three times during season of use.
Alluvial land, gravelly: AG.	Severe: coarse fragments on surface; slopes of 10 percent in places.	Severe: coarse fragments on surface; subject to flooding during season of use.	Moderate: subject to flooding for short periods during season of use.	Moderate: subject to flooding two or three times during season of use.
Alluvial land, saline: AM.	Slight-----	Slight-----	Slight-----	Slight.
Ancho: An----- Ao-----	Moderate: clay loam surface layer. Severe: high water table.	Moderate: clay loam surface layer. Severe: high water table.	Moderate: clay loam surface layer. Severe: high water table.	Moderate: clay loam surface layer. Severe: high water table.
Apache: AP-----	Severe: stoniness; slopes of 15 percent in places.	Severe: stoniness; slopes of 15 percent in places.	Moderate: stoniness----	Moderate: stoniness.
Badland: BA-----	Severe: steep slopes----	Severe: steep slopes----	Severe: steep slopes----	Severe: steep.
Basalt rock land: BD---	Severe: rockiness; very steep slopes.	Severe: rockiness; very steep slopes.	Severe: rockiness; very steep slopes.	Severe: rockiness; very steep slopes.
Bernal----- Mapped only in complex with Travessilla soils.	Severe: bedrock at depth of 8 to 20 inches.	Slight-----	Slight-----	Slight.

TABLE 8.—*Limitations of the soils for use in recreation—Continued*

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
Bluewing: Be-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
Bf-----	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Bg, BH-----	Moderate: loamy fine sand surface layer; slopes of 3 percent in places.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.
*Bobtail: BM, BO----- For Rock outcrop part of BO, see Rock outcrop.	Severe: slopes of more than 20 percent.	Severe: slopes of more than 20 percent.	Severe: slopes of more than 20 percent.	Moderate where slopes are 20 to 25 percent. Severe where slopes are more than 25 percent.
Borrego: BR-----	Severe: bedrock at depth of less than 20 inches; slopes of more than 10 percent.	Moderate where slopes are less than 15 percent. Severe where slopes are 15 to 30 percent.	Moderate where slopes are less than 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 10 to 15 percent. Moderate where slopes are 15 to 30 percent.
Calabasas: CA, CB-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 10 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight.
*Capillo: CC-----	Severe: slopes of more than 10 percent.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
CE----- For Rock outcrop part, see Rock outcrop.	Severe: rockiness; slope.	Severe: rockiness; slope.	Severe: rockiness; slope.	Severe: rockiness; slope.
Cerrillos: Cf, CG, Ch----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 10 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 10 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 10 percent.	Slight.
Chimayo: CM-----	Severe: bedrock at depth of less than 20 inches; slope.	Severe: slopes of more than 30 percent; stoniness.	Severe: slopes of more than 30 percent; stoniness.	Severe: slopes of more than 30 percent; stoniness.
Clovis: CO-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 3 percent.	Slight-----	Slight-----	Slight.
Cueva: CU-----	Severe: steep slopes; stoniness; clay surface layer.	Severe: steep slopes; stoniness; clay surface layer.	Severe: steep slopes; stoniness; clay surface layer.	Severe: steep slopes; stoniness; clay surface layer.
Cundiyo: CV-----	Severe: steep slopes-----	Severe: steep slopes-----	Severe: steep slopes-----	Severe: steep slopes.
*Dean: DP----- For Pastura part, see Pastura series.	Severe: caliche at depth of less than 20 inches.	Slight-----	Slight-----	Slight.
*El Rancho: Ec, Ed, Ee, EL----- For Fruitland part of EL, see Fruitland series.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.

TABLE 8.—*Limitations of the soils for use in recreation—Continued*

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
El Rancho, variant: Eh.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight.....	Slight.....	Slight.
Encierro: EN.....	Severe: 15 to 35 percent stones on surface; slopes of 20 percent in places.	Severe: 15 to 35 percent stones on surface; slopes of 20 percent in places.	Severe: 15 to 35 percent stones on surface; slopes of 20 percent in places.	Severe: 15 to 35 percent stones on surface.
Fivemile: Fe, FF.....	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.....	Slight.....	Slight.
Fortwingate, variant: FG.	Severe: slopes of more than 30 percent.	Severe: slopes of more than 30 percent.	Severe: slopes of more than 30 percent.	Severe: slopes of more than 30 percent.
Fruitland: Fn, Fr, Ft....	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.....	Slight.....	Slight.
Fruitland, saline: Fs....	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Galisteo: GG.....	Severe: slow permeability.	Slight: 15 percent gullied land.	Slight: 15 percent gullied land.	Slight: 15 percent gullied land.
Guaje: GL.....	Severe: slopes of more than 10 percent.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are 10 to 15 percent. Moderate where slopes are 15 to 30 percent.
Hagerman: HA.....	Moderate: bedrock at depth of 20 to 40 inches.	Slight.....	Slight.....	Slight.
*Harvey: HC, HD, HP, HR. For Dean part of HD, see Dean series; for Penistaja part of HP, see Penistaja series; and for Cerrillos part of HR, see Cerrillos series.	Slight where slopes are less than 2 percent. Moderate where slopes are more than 2 percent.	Slight.....	Slight.....	Slight.
La Brier: LB.....	Severe: subject to flooding; slow permeability.	Severe: subject to flooding during season of use.	Moderate: subject to flooding.	Moderate: subject to flooding during season of use.
La Fonda: Lf.....	Moderate where slopes are 3 to 8 percent. Severe where slopes are 8 to 10 percent.	Slight where slopes are 3 to 8 percent. Moderate where slopes are 8 to 10 percent.	Slight where slopes are 3 to 8 percent. Moderate where slopes are 8 to 10 percent.	Slight.
*Laporte: Lg, LH..... For Rock outcrop parts, see Rock outcrop.	Severe: bedrock at depth of less than 20 inches.	Severe: 25 percent rock outcrops.	Moderate: 25 percent rock outcrops. Severe where slopes are more than 15 percent.	Moderate: 25 percent rock outcrops.
Las Lucas: LL.....	Moderate: slow permeability.	Slight.....	Slight.....	Slight.
*Los Alamos: LS..... For Silver part, see Silver series.	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 10 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 10 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 10 percent.	Slight.

TABLE 8.—*Limitations of the soils for use in recreation—Continued*

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
Lunch, variant: LU-----	Severe: poorly drained..	Severe: poorly drained..	Severe: poorly drained..	Severe: poorly drained.
Majada: MA-----	Severe: slopes of more than 20 percent; stony.	Severe: slopes of more than 20 percent; stony.	Severe: slopes of more than 20 percent; stony.	Moderate where slopes are 20 to 25 percent. Severe where slopes are more than 25 percent.
McVickers, variant: MC.	Moderate where slopes are 5 to 8 percent. Severe where slopes are 8 to 20 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 20 percent.
*Mirabal: MD, ME, MF. For Rock outcrop part of MF, see Rock outcrop.	Severe: stoniness; slope..	Severe: stoniness; slope..	Severe: stoniness; slope..	Severe: stoniness; slope.
Montoso: MG, MH----	Moderate where slopes are 5 to 8 percent. Severe where slopes are 8 to 60 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Moriarty: MO-----	Severe: silty clay surface layer; very slow permeability.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
*Nambe: NA, NB, NE, NM, NR. For Rock outcrop parts of NM and NR, see Rock outcrop.	Severe: stoniness; slope..	Severe: stoniness; slope..	Severe: stoniness; slope..	Severe: stoniness; slope.
Ortiz: OG-----	Moderate where slopes are 5 to 8 percent. Severe where slopes are 8 to 40 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
*Otero: OP----- For Palma part, see Palma series.	Slight where slopes are less than 2 percent. Moderate where slopes are more than 2 percent.	Slight-----	Slight-----	Slight.
Palma----- Mapped only in complex with Otero soils.	Slight where slopes are less than 2 percent. Moderate where slopes are more than 2 percent.	Slight-----	Slight-----	Slight.
Panky: Pa, PB-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
Pastura----- Mapped only in complex with Dean soils.	Severe: indurated caliche at depth of 8 to 20 inches.	Slight-----	Slight-----	Slight.
Pena: PC-----	Severe: slope; stones on surface.	Severe: slope; stones on surface.	Moderate where slopes are 1 to 15 percent. Severe where slopes are more than 15 percent; stoniness.	Moderate: stones on surface.

TABLE 8.—*Limitations of the soils for use in recreation*—Continued

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
Penistaja: PD-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
Penitente: PE-----	Severe: coarse fragments on surface; slope.	Moderate: coarse fragments on surface. Severe where slopes are 15 to 30 percent.	Moderate: coarse fragments on surface. Severe where slopes are 15 to 30 percent.	Moderate: coarse fragments on surface. Severe where slopes are 25 to 30 percent.
Persayo: PH-----	Severe: bedrock at depth of less than 20 inches; slope.	Severe: 30 percent rock land.	Moderate: 30 percent rock land.	Moderate: 30 percent rock land.
*Pojoaque: PK, Pm, PN. For Panky part of PK, see Panky series; for Rough broken land parts of Pm and PN, see Rough broken land.	Moderate where slopes are 5 to 8 percent. Severe where slopes are more than 8 percent.	Moderate where slopes are 5 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 5 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.
Prewitt: PR-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
*Rednun: RD, RE, RG. For Pena part of RE, see Pena series; for Travessilla part of RG, see Travessilla series.	Moderate: slow permeability.	Slight-----	Slight-----	Slight.
Riverwash: RH-----	Severe: subject to frequent flooding.	Severe: subject to frequent flooding.	Severe: subject to frequent flooding.	Severe: subject to frequent flooding.
*Rock outcrop: RK, RL. For Chimayo part of RL, see Chimayo series.	Severe: rockiness-----	Severe: rockiness-----	Severe: rockiness-----	Severe: rockiness.
Rock slides: RO-----	Severe: rockiness; steep slopes.	Severe: rockiness; steep slopes.	Severe: rockiness; steep slopes.	Severe: rockiness; steep slopes.
Rough broken land: RU.	Severe: slope-----	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.
*Santa Fe: SF, Sk, SM. For La Fonda part of SF, see La Fonda series; for Rock outcrop parts of Sk and SM, see Rock outcrop.	Severe: bedrock at depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 25 percent.
*Silver: SP, SR----- For Pojoaque part of SP, see Pojoaque series.	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 10 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 10 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 10 percent.	Slight.

TABLE 8.—*Limitations of the soils for use in recreation—Continued*

Soil series and map symbols	Playgrounds	Camp areas	Picnic areas	Paths and trails
Stony rock land: ST----	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
*Supervisor: SU, SV For Rock outcrop part of SV, see Rock outcrop.	Severe: slope; rockiness.	Severe: slope; rockiness.	Severe: slope; rockiness.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
*Tapiá: TA----- For Dean part, see Dean series.	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
*Travessilla: TB, TR-- For Bernal part of TB, see Bernal series; for Rock outcrop part of TR, see Rock outcrop.	Severe: bedrock at depth of less than 20 inches.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.
Tuff rock land: TU-----	Severe: rockiness; slope.	Severe: rockiness; slope.	Severe: rockiness; slope.	Severe: rockiness; slope.
Wilcoxson, variant: WC.	Severe: slope-----	Severe: slope-----	Severe: slope-----	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Willard: WL-----	Slight-----	Slight-----	Slight-----	Slight.
Witt: WN-----	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 5 percent.	Slight-----	Slight-----	Slight.
Zuni, variant: ZU-----	Severe: slope-----	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are less than 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.

## Formation and Classification of the Soils

In this section the factors and main processes involved in soil formation are explained, soil horizons are discussed, and the soils of the Santa Fe Area are classified in the higher categories.

### Factors of Soil Formation

Soil is a natural body and is the result of interaction of the five soil-forming factors; climate, plants and animals, parent material, relief, and time. Each soil has three dimensions—thickness, breadth, and length. Individual soils range from a few square yards to several hundred acres in size. In places only one of the soil-forming factors has a dominant influence on the morphological characteristics of a particular soil. For example, slope has had a major effect on the formation of Pastura loam, which is underlain by indurated caliche at a depth of 8 to 20 inches. In other soils, such as Witt loam and Penistaja fine sandy loam, it is difficult to single out any one of the five soil-forming factors as being dominant in their formation.

Climate and vegetation, however, are considered the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly alter the parent material into a natural formation that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the formation of distinct horizons.

### Parent material

The soils in the Santa Fe Area formed in material weathered from many sources, ranging from Precambrian rock to recent sediment. The numerous kinds of rock and their varying age have contributed to the large number of different kinds of soil in the survey area. The Sangre de Cristo Mountains, in the northeastern part of the survey area, are Precambrian schist and gneiss intruded by granite. The weathering of these rocks furnished the parent material for many of the soils, such as those in the Chimayo, Mirabal, Supervisor, Bobtail, Borrego, and Zuni variant series.



Glacial action is not extensive in New Mexico. Some of the high mountains, however, have glacial till parent material. The Nambé and Penitente soils formed in glacial till derived from granite, gneiss, and schist.

In the northwestern part of the survey area the soils formed in material weathered from volcanic rock. The Montoso soils formed in material weathered from cinders; the Majada and Apache soils, from weathered basalt; and the Guaje soils, from tuff and pumice. Soils that formed in mixed alluvium and wind-worked material derived mainly from volcanic debris are those of the Silver, Calabasas, and Los Alamos series.

Between the mountains to the east and the mountains to the west is a broad, westward sloping, dissected piedmont plain. This area consists of alluvial material of the Santa Fe formation that has been reworked by water. Strata of sand, gravel, and cobblestones, as well as layers of poorly consolidated sandstone and siltstone, are present throughout the Area. From the Santa Fe River northward to the survey area boundary, drainage channels are well defined, erosion has been very active, and slopes generally are steep. Present in this type of material is soil of the Pojoaque series and the land types Rough broken land and Badland that are mapped with other soils. Within the same parent material but south of the Santa Fe River, the Panky, Cerrillos, and Agua Fria soils formed. In this area erosion is slight, and the soils are nearly level to strongly sloping.

In the central part of the Santa Fe survey area, in the vicinity of Galisteo and Cerrillos, the soils formed in material weathered from shale. Among these soils are those of the Las Lucas and Persayo series.

To the east and northeast of the Estancia Valley is an upland which is essentially the southern extension of the Glorieta Mesa. The soils in this area formed in material weathered mainly from sandstone. They include the Bernal and Travessilla soils.

The southern fourth of the survey area is in the Estancia Valley. Generally, the soils in this area formed in old alluvium that has a high percentage of calcium carbonate. In soils like those of the Pastura, Dean, and Harvey series, the calcium carbonate is still disseminated throughout the profile. In soils like those of the Clovis and Witt series, a distinct accumulation of secondary calcium carbonate is below the solum.

### **Time**

A long time is generally required for soil formation. The length of time that soil-forming forces have been able to act on parent material is commonly reflected in the character of the soil.

Soils in the survey area range from young soils that have few or indistinct horizons to older soils that have distinct horizons.

Increased content of clay in the B horizon and the strong accumulation of carbonates in the Cca horizon of Panky soils suggests that Panky soils are much older than El Rancho soils, even though the topography for both soils is about the same. El Rancho sandy clay loam is an example of a young soil. It retains most of the characteristics of its calcareous parent material, except for a darkening of the A horizon. The Panky soil is an example of an older soil that formed in the same kind of parent material as El Rancho sandy clay loam. It has a B horizon of noncalcare-

ous light to heavy clay loam. The Cca horizon contains a strong concentration of carbonates that bear little resemblance to the original parent material.

As the soils increase in age, the soil-forming processes produce changes which are of great importance to farmers.

In this survey area nearly all of the soils irrigated by surface water are on recently deposited alluvium along stream bottoms. These soils are generally deep, moderately permeable, and rich in most mineral plant nutrients. They have no discernible horizons other than a small accumulation of organic matter in the A horizon.

In the southern part of the survey area the soils are much older. Soils like those in the Witt and Clovis series have distinct horizons. They have a marked increase in content of clay in the B horizon. These soils are generally free of carbonates in the A and B horizons and have a corresponding increase in carbonates below the solum. In the B horizon structure is well defined and color has changed from that of the surface layer. These characteristics not only affect the inherent properties of the soil, they have a marked influence on such management practices as fertilization, irrigation, leveling, and tillage.

### **Relief**

The shape of the landscape influences soil formation because it affects drainage, erosion, plant cover, and soil temperature. Generally the deeper soils that have distinct horizons are gently sloping. Runoff is slow on these soils, and the loss of soil material by erosion is slight. The shallower soils that have less distinct horizons are steep and are on ridgetops. Runoff is rapid on these soils, and they have formed more slowly.

Soil-forming processes have varied greatly within short distances as a result of abrupt and significant changes in relief. Soils that show little or no formation may lie next to deep soils that have distinct horizons. For example, the deep, nearly level to gently sloping Panky soils that have distinct horizons adjoin the gently rolling to moderately steep Pojoaque soils that have faint horizons. In both cases the soils formed in old mixed alluvium. The difference in relief largely explains the difference in their profiles.

Northerly and southerly exposures are markedly different in their effect on soil formation in this survey area. Especially at the higher elevations and in the steeper areas, the soils that have north-facing slopes have a thicker layer of litter and a darker and thicker A1 horizon than the soils that have south-facing slopes. The Supervisor soils that have north-facing slopes and the Chimayo soils that have south-facing slopes are examples of the differences that result from aspect. At lower elevations and where topography is more gentle, differences in aspect have much less effect on soil formation.

Distinct differences in soil morphology are associated with relatively minor difference in slope and landform within a given landscape. In such circumstances relief influences soil formation because it controls runoff. Where the total amount of rainfall is small, a slight difference in the supply of moisture may account for a relatively great difference in soil morphology. In the drier parts of the area, soils in concave areas where runoff water concentrates show more distinct horizons than those on convex slopes where water runs off. This contrast is evident when the thicker and darker A horizon and distinct B2t

horizon of such a soil as the La Brier soil is compared with those of the Harvey soil.

Runoff from sloping soils and convex areas results in the soils of these areas being much drier than the soils of other areas. Such soils have a thin A horizon and are mostly shallow. There is little movement of salts or lime in their profiles. Apache and Travessilla soils are typical.

### ***Plants and animals***

Plants help in the formation of soils by sending their roots into the earthy parent material. Plant roots, even though small, are strong. They tend to granulate the soil, rearrange the soil particles, force openings in the lower part of the soil, and modify porosity. Animals burrow beneath the surface and mix the soil material. Earthworms and prairie dogs are active in the soils of the Santa Fe Area at the lower elevations. When animals and plants die, their remains decay and form humus in the soil. The humus serves as a storehouse for plant nutrients.

The native vegetation in the Santa Fe Area consists mainly of short grasses with some pinyon and juniper at the lower elevations. At elevations of more than about 7,500 feet, the vegetation changes to ponderosa pine, mixed conifers, spruce and fir, and aspen. Alpine turf is present above the timber line.

Except for the mountainous areas above an altitude of about 7,500 feet, the yearly return of organic matter to the soil in the Area is small. It is largely in the form of roots. As a result, the soils have a relatively low amount of organic matter in their A horizons and a rapid decrease in organic-matter content below a depth of 6 to 8 inches. As a result of this distribution of organic matter, the soils generally have a fragile, crustlike, vesicular, poorly aggregated surface layer 1 to 2 inches thick. This layer is underlain by more stable and more firmly aggregated A<sub>12</sub> and B horizons.

Several thousand acres of soil in the Santa Fe Area support stands of conifers, aspen, and, to a limited extent, alpine turf above the timberline. A general correlation exists between types of stands and altitude, precipitation, and vegetation.

These wooded soils are porous as a result of the presence of large amounts of organic debris; the activity of fungi, bacteria, and minute animals; and the penetration of the soil by the roots of trees and lesser vegetation.

### ***Climate***

Because elevation ranges from about 6,200 to 12,000 feet, the Santa Fe Area has a considerable range in temperature and precipitation. The average temperature at the lower elevations is around 50° F. The average maximum temperature ranges from 61° in the north to 66° in the south. The average minimum temperature, on the other hand, ranges from 37° in the north to 32° in the south. The average temperature at the higher elevations is less than 47°, and the average maximum and minimum are considerably lower than those given for the lower elevations. The annual precipitation in the Santa Fe Area ranges from 11 to 14 inches at lower elevations, but it increases with elevation. The annual average is 34 inches at 11,600 feet, 24 inches at 9,800 feet, and 20 inches at 8,500 feet.

Climate generally determines the kind and density of plants that grow in an area and hence the amount of organic matter that accumulates in the soil. In areas of low precipitation the stand of native plants is sparse, periods of sunshine are long, and the temperature and rate of evaporation in summer are high. As a result the soils are low in content of organic matter. The soils at the higher elevations have a higher content of organic matter because of a denser stand of vegetation that resulted from increased precipitation and lower temperature and rate of evaporation. A long time is required for sediment to weather in areas of low precipitation, despite warm temperature. High temperatures encourage the rapid weathering of soil material. In dry climates, however, the rate of weathering slows because the scarcity of water limits the amount of weathering that can take place. At higher elevations where precipitation is more plentiful, weathering is slowed because temperature is lower. In these areas the soils may remain frozen for long periods.

### **Soil Horizons**

The action of soil-forming factors is reflected in the soil profile, which is a succession of horizons, or layers, from the surface down to unaltered parent material. The horizons, roughly parallel to the surface of the soil, differ in one or more such properties as color, texture, thickness, structure, consistence, porosity, and reaction.

Many of the soils of the Area, such as those of the Clovis, Panky, and Witt series, have an A horizon that is generally light colored and contains some organic matter.

The La Brier, Bernal, and Santa Fe soils have a thick, dark-colored A horizon in which a significant amount of organic matter accumulates.

In places the Bt and B<sub>2</sub> horizons are at the surface instead of in the subsoil because of erosion or land leveling. Panky, Cerrillos, and Agua Fria soils are examples of soils that have a Bt horizon. Bt horizons have a significant accumulation of silicate clays. Clay films on the surface of natural aggregates indicate a downward movement of clay from the A horizon.

La Fonda, Calabasas, and Las Lucas soils exemplify soils that have B<sub>2</sub> horizons. In such horizons the soil-forming processes have altered the earthy parent material enough to form structure, liberate free iron oxides, and form silicate clays.

The letter "C" is used to designate horizons of unweathered parent material. The C horizons may occur under the A horizon, as is the case in the youthful El Rancho soils that have a light-colored surface layer over parent material that is only slightly altered. The C horizon may also occur under a B<sub>2t</sub> or B<sub>2</sub> horizon. For example, the older Panky soils have a light-colored surface layer and a horizon of silicate clay accumulation over parent material that is only slightly altered. The Panky and El Rancho soils formed in similar parent material.

Many of the soils of the Area have horizons of calcium carbonate accumulation that are identified by "ca" following either Bt or C horizon designators. Horizons designated by "ca" have more calcium carbonate than the materials in which the soil formed, as is evidenced by lime segregations or lime coatings on coarse fragments or sand grains.

## Classification of the Soils

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranches, or land-resource areas. They are placed in broad classes for study and comparison of large areas, such as States, regions, or continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (2) and revised later (7). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and adopted in 1965. It is under continual study (5, 8).

### *Grouping of the soils in higher categories*

The purpose of soil classification is to help us remember the significant characteristics of soils, to assemble our knowledge about them, to see their relationships to one another in their environment, and to develop principles of their behavior and response to manipulation.

The current classification is a comprehensive system designed to accommodate all soils. In this system, classes are defined in terms of observable or measurable properties. They were selected mainly to group soils of similar morphological characteristics. The properties selected, however, have either affected soil genesis or resulted from soil genesis. This system has a technical nomenclature that is both connotative and distinctive.

There are six categories in the current system. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. There are few classes in the highest category, the order, and many classes in the lowest category, the series. Soils that are similar in important characteristics are grouped at each level in the system. For example, generalizations of common properties that tend to give broad climatic grouping of soils are used to separate the orders. Exceptions are the Entisols, Histosols, Inceptisols, and Vertisols that are in many different climates.

Each order is divided into suborders, primarily on the basis of characteristics that seem to produce classes having genetic similarity. Mainly, these are characteristics that reflect the presence or absence of waterlogging or soil differences resulting from climate or vegetation. The climatic range is narrower than that of the orders.

The great groups are divided on the basis of uniformity of kinds and sequences of major soil horizons and features. The horizons used are those in which clay, iron, or humus accumulate, or those in which a pan forms and interferes with root growth or water movement.

The subgroups are subdivisions of the great groups. They consist of the central (typic) segments or intergrades that have, in addition to properties of the great group, one or more properties of another great group, suborder, or order.

The families are divided mainly on the basis of texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Except for texture of the surface layer, the series is a group of soils that have major horizons that are similar in important characteristics and in arrangement in the profile.

The soils of the Santa Fe Area are placed into series, family, subgroup, and order in table 9.

## *Additional Facts About the Area*

This section contains general information about the Santa Fe survey area. Among the features described are climate, history and population, water for irrigation, physiography, relief and drainage, and land use.

### **Climate<sup>4</sup>**

The Santa Fe survey area is located in north-central New Mexico between the 35th and 36th parallels and is approximately bisected by the 106th meridian. The northern two thirds of the survey area is in the northern mountains climatic division of the State, and the southern third is in the central highlands division.

Few weather stations in the Santa Fe Area have long records. The exception is Santa Fe, where records extend back to 1850. Several stations having reasonably long records are in adjacent counties not far from the border of the survey area. Their records have been considered in evaluating the climate.

Table 10 summarizes temperature data for Santa Fe and is quite representative of the survey area below an elevation of about 8,000 feet. Above 8,000 feet the temperature lowers an average of about 3 degrees for every 1,000 feet increase in elevation. Extremely low temperatures, however, are 10 degrees lower in the south than at the city of Santa Fe.

The average temperature at the lower elevations in the Santa Fe Area is around 50° F. The average maximum temperature ranges from 61° in the north to 66° in the south, and the average minimum temperature ranges from 37° in the north to 32° in the south. The cooler maximum temperatures and warmer minimum temperatures in the north result from both the higher elevation of the north and the greater cool-air drainage in the south. An extreme high temperature of 99° was recorded at Stanley on July 4, 1957 and on earlier dates. A similar high temperature was recorded at Otto on July 2, 1953 and on earlier dates. An extreme low temperature of -28° was recorded at Otto on February 1, 1951.

Figure 17 shows the probability date of selected threshold Fahrenheit temperatures in spring and in fall at Santa Fe. Similar temperatures may be expected in other areas of lower elevation in the Area. Considerable variation in the actual dates is likely, however, as a result of local topography, radiation, and cold-air drainage. This holds true even in nearby orchards or farms. The period between the last instance of 32° or less in spring and first instance of 32° or less in fall at Santa Fe averages 165 days, the period between May 3 and October 15.

Average annual precipitation in the Santa Fe area ranges from 11 inches to 14 inches at the lower elevations, but some protected spots may get little more than 9 inches. The average rainfall generally increases with elevation. The distribution of precipitation at Santa Fe is shown in table 10 and is generally representative of the lower elevations. A much greater annual average precipitation falls in the mountains. Almost 34 inches falls at Santa Fe Lake (about 11,600 feet), 24 inches falls at Big Tesuque Ski Course (about 9,800 feet), and 20 inches

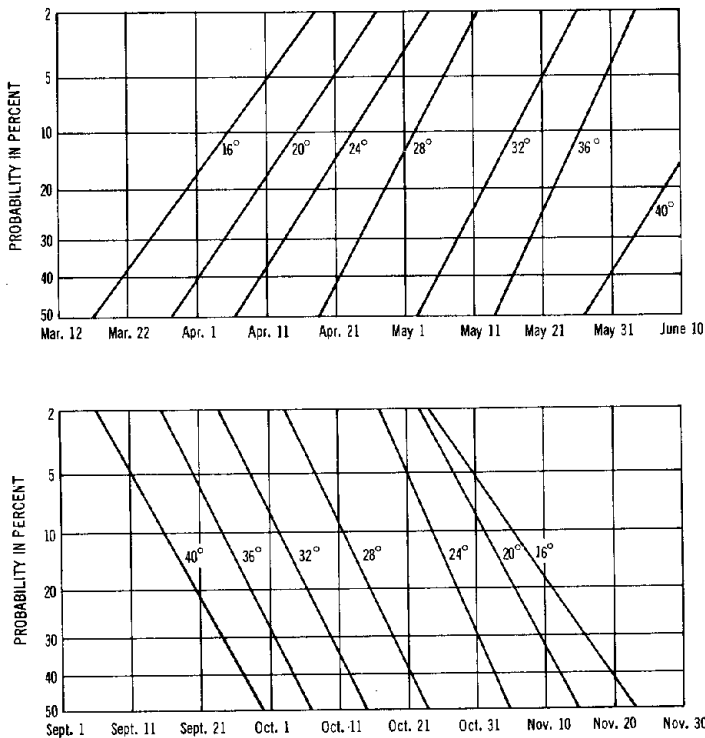
<sup>4</sup>By FRANK E. HOUGHTON, climatologist for the State of New Mexico, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Classification of the soils into higher categories*

Series	Family	Subgroup	Order
Adel	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols.
Agua Fria	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Ancho	Fine-silty, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Apache	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Bernal	Loamy, mixed, mesic	Lithic Argiustolls	Mollisols.
Bluewing <sup>1</sup>	Sandy-skeletal, mixed, mesic	Typic Torriorthents	Entisols.
Bobtail	Coarse-loamy, mixed	Typic Cryochrepts	Inceptisols.
Borrego	Clayey, mixed	Lithic Eutroboralfs	Alfisols.
Calabazas	Fine-silty, mixed, mesic	Ustollic Camborthids	Aridisols.
Capillo	Fine, mixed	Typic Argiborolls	Mollisols.
Cerrillos	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Chimayo	Loamy-skeletal, mixed, nonacid, mesic	Lithic Ustorthents	Entisols.
Clovis	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Cueva	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Cundiyo	Loamy-skeletal, mixed	Typic Cryoboralfs	Alfisols.
Dean	Fine-loamy, carbonatic, mesic	Ustollic Calciorthids	Aridisols.
El Rancho	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
El Rancho, sandy subsoil variant.	Fine-loamy, over sandy or sandy-skeletal, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Encierro	Clayey, mixed, mesic	Lithic Argiustolls	Mollisols.
Fivemile	Fine-silty, mixed (calcareous), mesic	Typic Torrifluvents	Entisols.
Fortwingate, loamy subsoil variant.	Fine-loamy, mixed	Typic Eutroboralfs	Alfisols.
Fruitland	Coarse-loamy, mixed (calcareous), mesic	Typic Torriorthents	Entisols.
Galisteo	Fine, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Guaje	Medial-skeletal, mesic, shallow	Ustollic Calciorthids	Aridisols.
Hagerman	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Harvey	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols.
La Brier	Fine, mixed, mesic	Torrertic Argiustolls	Mollisols.
La Fonda	Fine-loamy, mixed, mesic	Ustollic Camborthids	Aridisols.
Laporte	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Las Lucas	Fine-silty, mixed, mesic	Ustollic Camborthids	Aridisols.
Los Alamos	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Lunch, shallow variant.	Fine-silty, mixed (noncalcareous)	Histic Cryaquolls	Mollisols.
Majada	Loamy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
McVickers, kaolinitic variant.	Fine, kaolinitic	Typic Cryoboralfs	Alfisols.
Mirabal	Loamy-skeletal, mixed, nonacid, frigid	Typic Ustorthents	Entisols.
Montoso	Loamy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Moriarty	Fine, mixed, mesic	Mollic Torrets	Vertisols.
Nambe	Loamy-skeletal, mixed	Typic Cryochrepts	Inceptisols.
Ortiz	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Otero	Coarse-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Palma	Coarse-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Panky	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Pastura	Loamy, mixed, mesic, shallow	Ustollic Paleorthids	Mollisols.
Pena	Loamy-skeletal, mixed, mesic	Aridic Calcistolls	Mollisols.
Penistaja	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Penitente	Loamy-skeletal, mixed	Typic Cryumbrepts	Inceptisols.
Persayo	Loamy, mixed (calcareous), mesic, shallow	Typic Torriorthents	Entisols.
Pojoaque	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Prewitt	Fine-loamy, mixed, mesic	Fluventic Haplustolls	Mollisols.
Rednun	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Santa Fe	Loamy-skeletal, mixed, mesic	Lithic Argiustolls	Mollisols.
Silver	Fine, mixed, mesic	Ustollic Haplargids	Aridisols.
Supervisor	Loamy-skeletal, mixed	Typic Cryoborolls	Mollisols.
Tapia	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Travessilla	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Wilcoxson, soft bed-rock variant.	Fine, mixed	Typic Argiborolls	Mollisols.
Willard	Fine-silty, mixed, mesic	Ustollic Calciorthids	Aridisols.
Witt	Fine-silty, mixed, mesic	Ustollic Haplargids	Aridisols.
Zuni, brown subsoil variant.	Fine, mixed	Mollic Eutroboralfs	Alfisols.

<sup>1</sup> Bluewing soils mapped in the Santa Fe Area occur at higher elevations and receive more precipitation than allowed within the defined range for the Bluewing series. They therefore are considered to be taxadjuncts to the Bluewing series. In addition, the Bluewing

soils in the survey area include hues of 7.5YR, which are not defined within the range for the Bluewing series. These differences do not alter the usefulness or behavior of the soils.



**Figure 17.**—*Top:* Probability of 16°, 20°, 24°, 28°, 32°, 36°, or 40° temperature in the spring after any indicated calendar date. *Bottom:* Probability of 16°, 20°, 24°, 28°, 32°, 36°, or 40° temperature in the autumn before any indicated calendar date.<sup>1</sup>

falls at Elk Cabin (about 8,500 feet). Other mountains in the survey area receive similar amounts at corresponding elevations.

Extremes of precipitation at the lower elevations, recorded at Santa Fe, are a highest annual amount of 24.80 inches in 1855 and a lowest annual amount of 5.03 inches in 1917. The greatest precipitation total for any month in Santa Fe was 7.89 inches in August 1855, and the greatest precipitation total for any day in Santa Fe was 2.82 inches on July 30, 1953.

At Santa Fe Lake as much as 52.93 inches of precipitation fell in one year, 1957; and as much as 10.90 in one month, January 1957.

Nearly 70 percent of the annual average precipitation falls at Santa Fe in the summer season, May through October. In the mountains at Santa Fe Lake, the summer precipitation is nearer 60 percent of the annual average. Snowfall averages for the year are more variable for similar elevations than for total precipitation. In areas of lower elevation snowfall ranges from about 10 to 35 inches, Santa Fe receiving 32 inches. In the higher mountains amounts well over 100 inches may fall during the season. The greatest total monthly snowfall at the lower elevations was 43.5 inches at Glorieta in March 1958.

Average annual evaporation from a standard evaporation pan at Santa Fe is 67 inches. This is tabulated by months in table 10. These summarized evaporation measurements are based on data taken at several locations in

the vicinity of Santa Fe, all within 3 miles of the post office and all having nearly equal elevations. Statistics show that the range of annual evaporation to be expected for two-thirds of the years is 62 to 72 inches. During the usual growing season, the six-month period May through October, 73 percent of the annual evaporation (about 49 inches) is to be expected.

Average annual relative humidity at Santa Fe is about 52 percent. Relative humidity data by months is summarized in table 10.

Winds at Santa Fe Airport average about 12 miles per hour. Monthly averages range from around 10 miles per hour in the summer to around 14 miles per hour in the spring. West-southwesterly winds prevail in spring, and north-northeasterly winds prevail during the rest of the year. Easterly winds are generally the least frequent throughout the year. The wind is calm 2 percent of the time. It is 1 to 12 miles per hour 51 percent of the time, and 13 to 24 miles per hour 36 percent of the time. Winds of 25 miles per hour or more occur 5 percent of the time. An average of 12 hours per year have winds of 39 to 46 miles per hour, but winds of 47 miles per hour or more are rare (only 2 hourly occurrences during the six years of record).

Local topography causes wind departures from the airport values at other places, particularly in the vicinity of the mountains.

## History and Population

Most of the history of the Santa Fe Area is centered around the Indian pueblos, the city of Santa Fe, and early mining in the Cerrillos, Madrid, and Golden areas.

For centuries the area in and around Santa Fe has been a desirable place to live because of its climate and the available supply of water for crops and domestic use.

Rodriguez, one of the earliest Spanish explorers, reported four Indian pueblos along the Santa Fe River in his account of an expedition to northern New Mexico in 1581 and 1582. Other Spanish explorers passed through the area until 1610, when a new settlement named La Villa Real de la santa fe de San Francisco de Assisi became the capital of the province of Nuevo Mejico. Santa Fe remained small; in 1617 the total Spanish population was reported as 48 soldiers and colonists. It is quite probable that these colonists built the first irrigation ditches in the area.

Santa Fe continued to grow under the Spanish government, except in the period 1680–92 when the Indians revolted and the Spanish were driven back to Mexico.

Santa Fe had a reported population of 6,000 when New Mexico came under Mexican rule in 1821. An attempted conquest of Santa Fe by an expedition from Texas was resisted in 1841, but Kearney's expedition in 1846 was successful, and New Mexico became a territory of the United States. New Mexico was admitted to statehood in 1912.

Sporadic mining in the survey area has continued from 1879 until now, and there is evidence that metal was mined before the Indian revolt in 1680 and again after the Spaniards returned in 1692. The major period of mining activity was in the early 1800's, but no production figures are available. However, a reported 25,843 tons of zinc, lead, and silver ores, and some copper and gold, was produced between 1909 and 1952. Several million dollars worth of turquoise was mined before 1905.

<sup>1</sup> All probability data based on records during 30-year period at Santa Fe.

TABLE 10.—*Climatological data*

[All data from Santa Fe. Period of record 1931-60]

Month	Temperature				Precipitation					Evapo- ration <sup>1</sup>	Relative humidity <sup>2</sup>	
	Aver- age daily maxi- mum	Aver- age daily mini- mum	Two years in 10 will have at least 4 days with—		Aver- age total	One year in 10 will have—		Average number of days that have precipitation of—			6 A.M.	6 P.M.
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	0.1 inch or more	0.25 inch or more			
	° F.	° F.	° F.	° F.	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>			<i>Inches</i>	<i>Percent</i>	<i>Percent</i>
January-----	41	19	53	4	0. 68	0. 2	1. 2	2	1	1. 51	74	58
February-----	45	23	57	8	. 69	. 2	1. 1	2	1	2. 19	73	49
March-----	52	27	64	13	. 78	. 1	1. 6	2	1	3. 93	68	40
April-----	62	35	74	24	. 83	. 2	1. 4	2	1	6. 44	63	30
May-----	71	43	82	33	1. 38	. 2	2. 7	3	2	9. 05	61	28
June-----	81	52	90	43	1. 17	. 2	2. 5	3	1	10. 67	56	24
July-----	84	57	91	51	2. 14	. 6	3. 5	6	3	9. 28	71	37
August-----	82	55	91	51	2. 23	1. 2	3. 6	6	3	7. 92	76	42
September-----	77	49	86	40	1. 41	. 2	2. 7	4	2	7. 03	68	41
October-----	65	39	76	29	1. 09	. 2	2. 4	3	1	4. 98	69	43
November-----	52	27	63	12	. 60	( <sup>3</sup> )	1. 3	2	1	2. 59	68	49
December-----	43	21	55	8	. 70	. 3	1. 4	2	1	1. 43	71	56
Year-----	63	37	4 93	5 -1	13. 70	10. 9	17. 6	37	18	67. 02	68	41

<sup>1</sup> Period of record 1916-64.<sup>2</sup> Period of record January 1939 to May 1948.<sup>3</sup> 0.005 inch, the smallest measurable amount.<sup>4</sup> Average annual highest temperature.<sup>5</sup> Average annual lowest temperature.

In 1960, according to the United States Department of Commerce Census, the city of Santa Fe had a population of 33,394, and the Santa Fe survey area, about 45,000.

In 1966, the population of the survey area was 48,700, or about 25 persons per square mile.

## Water for Irrigation

Irrigation water used in the Area comes from two sources. In the southern part of the survey area, the water is pumped from wells. In the northern part, surface water is diverted from streams and springs.

Irrigation in the southern part of the survey area is all within the Estancia Valley. The Estancia Valley is a closed basin, most of which lies in Torrance County, to the south of the survey area. Approximately 7,000 acres are pump irrigated from the basin within the survey area. The principal aquifer for supply wells for irrigation, stock, domestic, and community uses is the valley fill. The present development for irrigation began in 1940, but the greatest development has been since 1947. Observations of water levels show a maximum decline in water level, nearly 13 feet, between 1941 and 1952. Most wells range in depth from 100 to 300 feet. In general the water is chemically satisfactory for drinking and for domestic, stock, and irrigation use. In areas in the vicinity of the Old Lake Estancia, however, the water is generally undesirable to unsatisfactory for drinking and for most domestic use and irrigation, but it is satisfactory for stock water (6).

About 5,500 acres of surface irrigation systems are in the northern part of the survey area. Santa Cruz Dam, on

the Santa Cruz River, is the only storage for irrigation water. Also, water from eight or nine small streams is diverted directly onto the land. Most of these streams run intermittently with the result that the supply of irrigation water is uncertain. Generally, an adequate supply in the spring is provided from snowmelt and, in July and August, from thunderstorm activity, which is greatest at that time.

Chemically, the water is satisfactory for all purposes.

## Physiography, Relief, and Drainage

The Santa Fe survey area can broadly be divided into six physiographic units. Three of these—the Sangre de Cristo Mountains in the northeastern part (fig. 18); a westward-sloping, broad, dissected piedmont plain in the north-central part; and basalt flows of the lava mesa in the northern and central, western part are usually considered part of the Southern Rocky Mountain Physiographic Province. The other three physiographic units are in the southern half of the survey area and are within the Basin and Range Physiographic Province. They are the Cerrillos Hills and associated alluvial fans and plains in the western segment; the rolling hills and depressions area in the southeast, which is essentially the top of the Glorieta Mesa; and the southern part, which is a northern extension of the Estancia Valley. The plain in the northern part of the Estancia Valley may be a continuation of the piedmont plain south of the city of Santa Fe. The valley of Galisteo Creek separates these two plains.

The Sangre de Cristo Mountains, in which Precambrian and Pennsylvanian rocks outcrop, range in elevation from 12,622 feet on Santa Fe Baldy to about 7,000 feet at the



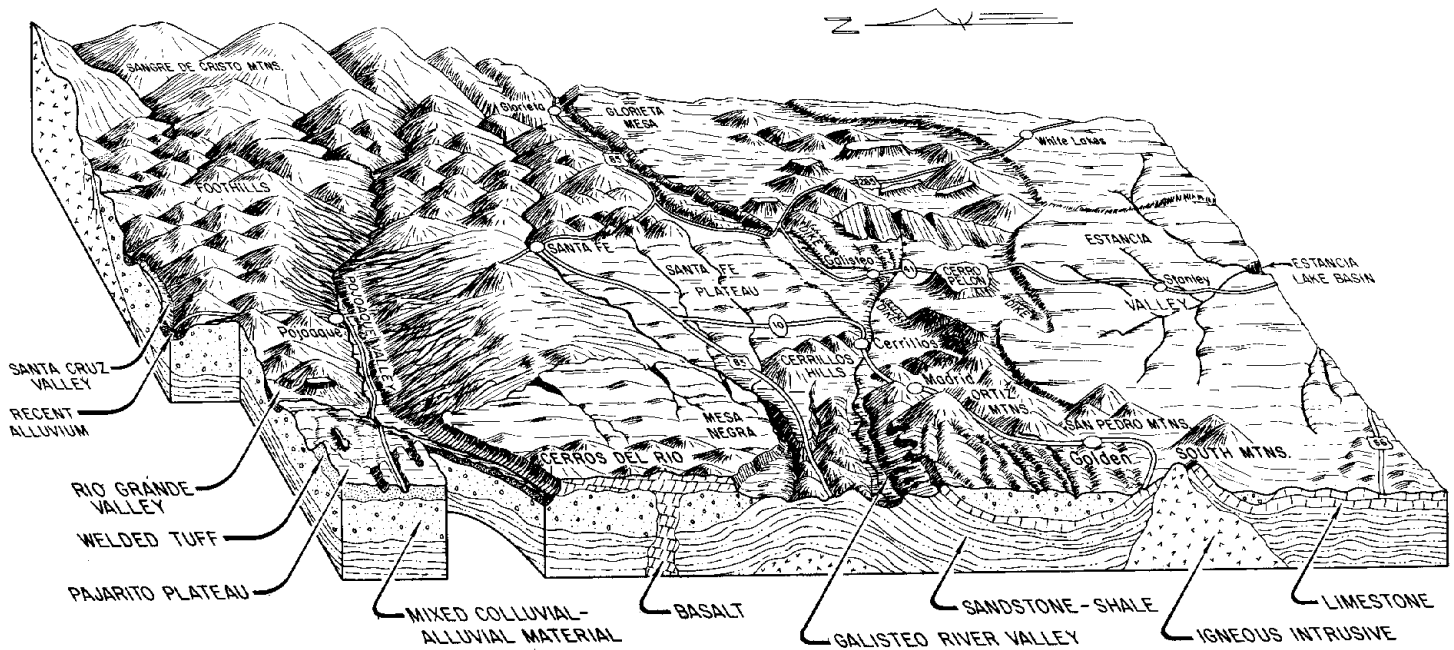


Figure 18.—The main physical features and geological strata of the Santa Fe Area.

base of the mountains where the alluvial fans begin. Drainage patterns are well defined, most of the drainage being into the Rio Grande. The eastern slopes of the Sangre de Cristo Mountains, of which a small part lies within the Santa Fe survey area, drain into the Pecos River in San Miguel County. Slopes in the mountains are generally steep or very steep. The amount of erosion varies, depending on precipitation, vegetative cover, and the presence of bed-rock.

A large part of the survey area is the somewhat dissected piedmont plain that butts against the mountains to the east and against the Cerrillos Hills to the southwest. To the west, it is buried under the lava flows of the mesa. Slopes are generally steep at the mountain front but gradually become more gentle as distance from the mountains increases. Drainage is well defined, especially where the major streams from the mountains flow. Generally there was one plain of formation. Erosion, however, has reduced much of the area to various topographic levels. Erosion has been so active in the northern half of the alluvial plains area that a badlands type of topography has formed. In the southern half of the alluvial plains area, erosion has been less active, and the major streams, especially the Santa Fe River, have formed distinct river terraces. Elevation ranges from approximately 6,000 to 7,000 feet.

The northwestern part of the survey area is capped by basalt that has poorly defined drainage patterns and shallow soils. A volcanic cluster of plugs and cinder cones dots the area. The height of the plugs and cones ranges from 100 to 500 feet. Elevation in the basalt area ranges from about 6,000 to 6,500 feet.

Elevation in the Cerrillos Hills and associated fans and plains area in the western part of the survey area ranges from 6,600 feet at the foot of the fans to 8,900 feet on the Ortiz Mountains. Slopes in the mountains and hills are

steep. Drainage is well defined, the runoff going into the Rio Grande.

The Estancia Valley part of the survey area ranges in elevation from 6,200 to 6,600 feet. Drainage is generally southward into Torrance County, toward the central part of the basin. Drainage patterns are moderately well defined to poorly defined.

To the east and northeast of the Estancia Valley, the upland is essentially the southern extension of the Glorieta Mesa. This upland is characterized by rolling hills in the northern and central part and by small, shallow basins in the southern part. The most prominent of the basins is White Lakes. At the extreme northern edge of the upland is the steep, north-facing scarp of the Glorieta Mesa. Drainage is well defined in the northern and central part and generally is into Galisteo Creek. The southern part has poorly defined drainage patterns, and runoff is into the small basins. Elevation in the upland ranges from 6,600 to 7,000 feet.

## Land Use

According to United States Census of Agriculture for 1964, 79.7 percent of the Santa Fe survey area is in farms. Most of the farms are owned by the operators, but a few are rented. There were 986,283 acres of land in farms, but only 6,452 acres of cropland were harvested, and only 5,817 acres were irrigated. The survey area had 368 farms, of which 117 were less than 10 acres in size, and 52 were larger than 2,000 acres in size. Most of the acreage of these large farms is in range and is used for beef cattle production.

The Santa Fe Area is not known for production of crops. Many different crops are grown, but some only to a very limited extent. More than one-third of the irrigated acreage harvested was alfalfa, and about one-fifth was small

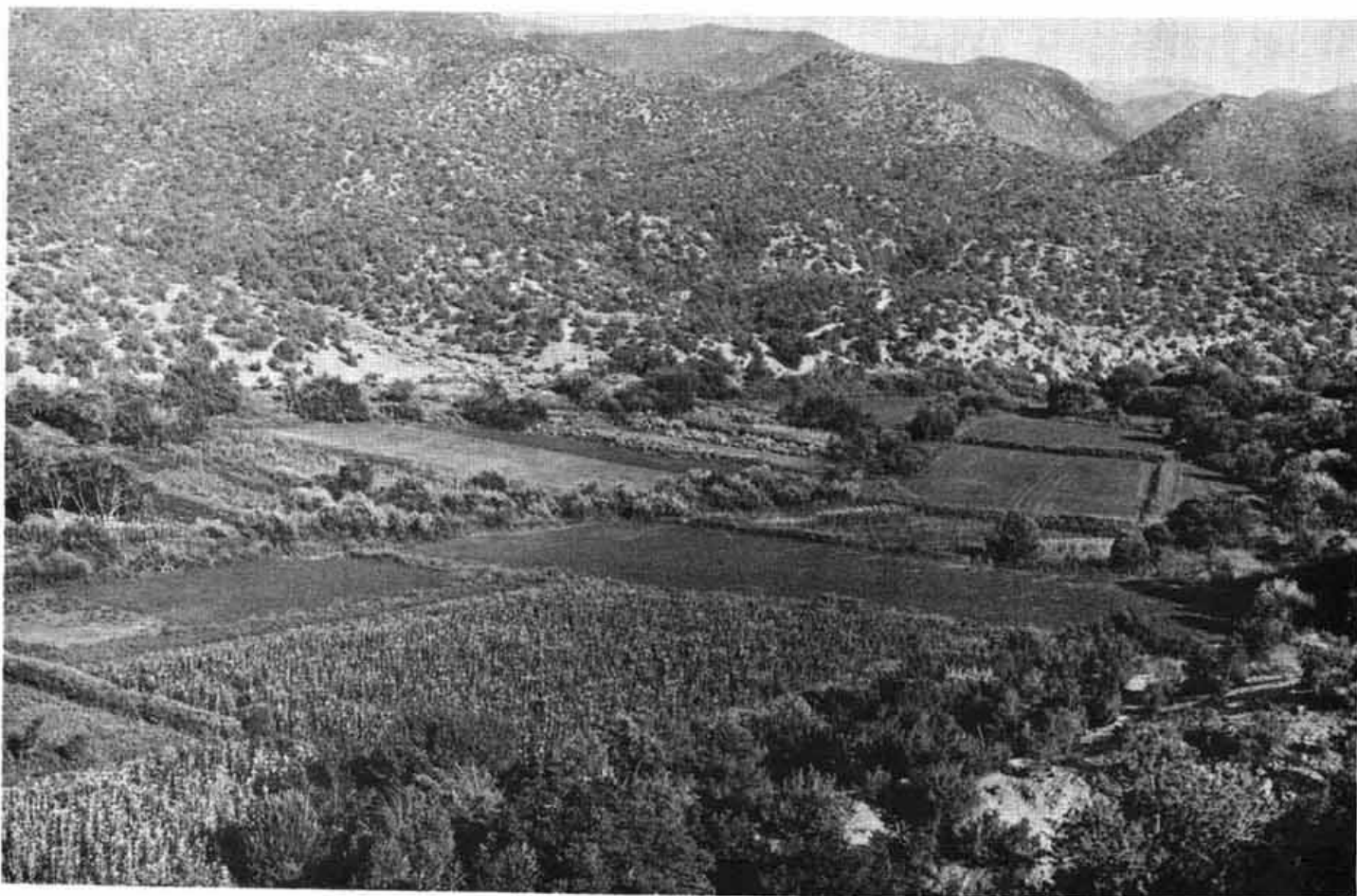


Figure 19.—Farmland in a small irrigated valley. The soils are mostly Ancho clay loam and El Rancho sandy clay loams.

grain. More than one-third of it was corn. About one-tenth, or 527 acres of irrigated land, is planted to fruit trees, most of which are apple trees (fig. 19).

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## Glossary

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or other kinds of physical manipulations of the soil.

**Alkali soil.** Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

**Alluvial fan.** A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Available water holding capacity** (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference

- between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Badlands.** Areas of rough, irregular land where most of the surface is occupied by ridges, gullies, and deep channels. Land hard to traverse.
- Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Caliche.** A more or less cemented deposit of calcium carbonate in many soils of warm-temperature areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay film.** A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.
- Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
- Loose.*—Noncoherent when dry or moist; does not hold together in a mass.
- Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
- Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
- Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
- Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
- Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
- Soft.*—When dry, breaks into powder or individual grains under very slight pressure.
- Cemented.*—Hard and brittle; little affected by moistening.
- Drainage class (natural).** Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.
- Excessively drained soils* are commonly very porous and rapidly permeable and have a low available water holding capacity.
- Somewhat excessively drained soils* are also very permeable and are free from mottling throughout their profile.
- Well-drained soils* are nearly free from mottling and are commonly of intermediate texture.
- Moderately well drained soils* commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.
- Somewhat poorly drained soils* are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.
- Poorly drained soils* are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
- Very poorly drained soils* are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.
- Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.
- Erosion.** The wearing away of the land surface by wind (sand-blast), running water, and other geological agents.
- Flood plain.** Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.
- Forb.** Any herbaceous plant, neither a mass nor a sedge, that is grazed on western ranges.
- Genesis, soil.** The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.
- Gravelly soil material.** From 15 to 50 percent of material, by volume, consisting of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:
- O horizon.*—The layer or organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
- A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
- B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
- C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.
- R layer.*—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.
- Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—
- Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
- Basin.*—Water is applied rapidly to relatively level plots surrounded by levees or dikes.
- Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
- Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.
- Furrow.*—Water is applied in small ditches made by cultivation implements used for tree and row crops.
- Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
- Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
- Wild flooding.*—Irrigation water, released at high points, flows onto the field without controlled distribution.
- Lacustrine deposit (geology).** Material deposited in lake water and exposed by lowering of the water level or elevation of the land.
- Loess.** Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.
- Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension;

*medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

**Parent material.** Disintegrated and partly weathered rock from which soil has formed.

**Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

**Phase, soil.** A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

**pH value.** A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

**Piedmont plain.** A large, continuous alluvial plain at the edge of tableland or mountain range, formed as a result of deposits from streams and rivers which, carried from the uplands, have adjoined at the lower and more level areas.

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent materials.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH		pH	
Extremely acid---	Below 4.5	Neutral -----	6.6 to 7.3
Very strongly acid---	4.5 to 5.0	Mildly alkaline-----	7.4 to 7.8
Strongly acid-----	5.1 to 5.5	Moderately alkaline---	7.9 to 8.4
Medium acid-----	5.6 to 6.0	Strongly alkaline-----	8.5 to 9.0
Slightly acid-----	6.1 to 6.5	Very strongly alkaline	9.1 and higher

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Saline soil.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

**Sand.** Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Series, soil.** A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Slope class name.** Word description of slopes provided in addition to the numerical slope range given in the correlated name of a mapping unit. The slope class name provides additional information by indicating whether slopes are single or complex, thus describing shape to some extent. These are the slope class names for this survey area:

Soil slope percentage	Single slopes	Complex slopes
0-1-----	Level-----	Nearly level
1-3-----	Nearly level-----	Gently undulating
3-5-----	Gently sloping-----	Undulating
5-9-----	Moderately sloping-----	Gently rolling
9-15-----	Strongly sloping-----	Rolling
15-30-----	Moderately steep-----	Hilly
30-50-----	Steep-----	Steep
50-80-----	Very steep-----	Very steep

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material as conditioned by relief over periods of time.

**Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** Technically, the part of the soil below the solum.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

**Terrace (geological).** An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silt clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Tilth, soil.** The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Variant, soil.** A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.



# GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability subclass or unit, range site, timber suitability group, or wildlife habitat group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Approximate acreage and extent, table 1, p. 11.  
Estimated yields, table 2, p. 64.  
Potential productivity of soils for timber,  
table 3, p. 67.

Suitability of soils for wildlife, table 4,  
p. 70.  
Engineering uses of soils, table 5, p. 74;  
table 6, p. 82; and table 7, p. 96.

## HIGH-INTENSITY SURVEY

Map symbol	Mapping unit	De- scribed on page	Dryland capability subclass	Irrigated capability unit	Range site	Timber suitability group	Wildlife habitat group
			Symbol Page	Symbol Page	Name	Number	Symbol
An	Ancho clay loam-----	14	-----	IIe-1 59	-----	-----	I
Ao	Ancho clay loam, saline-----	14	-----	VIw-1 62	-----	-----	I
Be	Bluewing loamy fine sand-----	16	-----	IVe-1 61	-----	-----	J
Bf	Bluewing loamy fine sand, saline-----	16	-----	VIw-1 62	-----	-----	J
Bg	Bluewing gravelly sandy loam-----	16	VIe 62	-----	Sandy	-----	A
Cf	Cerrillos fine sandy loam, 0 to 5 percent slopes-----	19	VIe 62	-----	Loamy	-----	B
Ch	Cerrillos fine sandy loam, 5 to 10 percent slopes-----	19	VIe 62	-----	Loamy	-----	B
Ec	El Rancho sandy clay loam, 0 to 1 percent slopes-----	23	-----	I-1 59	Loamy	-----	I
Ed	El Rancho sandy clay loam, 1 to 3 percent slopes-----	23	-----	IIe-1 59	Loamy	-----	I
Ee	El Rancho sandy clay loam, 3 to 5 percent slopes-----	23	-----	IIIe-2 60	Loamy	-----	I
Eh	El Rancho sandy clay loam, sandy subsoil variant-----	24	-----	IIIe-3 61	Loamy	-----	J
Fe	Fivemile loam-----	25	VIe 62	-----	Loamy	-----	C
Fn	Fruitland sandy loam, 0 to 3 percent slopes-----	26	-----	IIe-1 59	-----	-----	J
Fr	Fruitland sandy loam, 3 to 5 percent slopes-----	27	-----	IIIe-2 60	-----	-----	J
Fs	Fruitland sandy loam, saline, 0 to 3 percent slopes-----	27	-----	VIw-1 62	-----	-----	J
Ft	Fruitland sandy clay loam, 0 to 3 percent slopes-----	27	-----	IIs-1 60	-----	-----	J
Lf	La Fonda loam, 3 to 10 percent slopes-----	31	VIe 62	-----	Loamy	-----	C
Lg	Laporte-Rock outcrop complex, 5 to 25 percent slopes-----	31	VIIIs 63	-----	Shallow	-----	F
Pa	Panky fine sandy loam-----	40	VIe 62	-----	Loamy	-----	B
Pm	Pojoaque-Rough broken land complex-----	43	VIIe 62	-----	River Breaks	-----	F
Sk	Santa Fe-Rock outcrop complex, 5 to 25 percent slopes-----	46	VIIIs 63	-----	Hills	-----	F

## LOW-INTENSITY SURVEY<sup>1/</sup>

AD	Adel loam, 5 to 35 percent slopes-----	12	VIIe 62	-----	-----	2,4,8	H
AF	Agua Fria fine sandy loam-----	13	VIe 62	-----	Loamy	-----	D
AG	Alluvial land, gravelly-----	13	VIIe 62	-----	Mountain Valley	-----	F
AL	Alluvial land, cobbly-----	13	VIIe 62	-----	-----	2,5,9	G

## GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	De- scribed on page	Dryland capability subclass		Irrigated capability unit		Range site Name	Timber suitability group Number	Wildlife habitat group Symbol
			Symbol	Page	Symbol	Page			
AM	Alluvial land, saline-----	13	VIIe	62	-----	----	Salt Flats	-----	F
AP	Apache stony fine sandy loam, 1 to 15 percent slopes-----	14	VIIIs	63	-----	----	Malpais	-----	F
BA	Badland-----	15	VIIIe	63	-----	----	-----	-----	-----
BD	Basalt rock land-----	15	VIIIIs	64	-----	----	-----	-----	F
BH	Bluewing gravelly sandy loam---	16	VIe	62	-----	----	Sandy	-----	A
BM	Bobtail loam, 20 to 70 percent slopes-----	16	VIIe	62	-----	----	-----	4,7,11	G
BO	Bobtail-Rock outcrop complex, 40 to 90 percent slopes-----	17	VIIIs	63	-----	----	-----	6,9,12	G
BR	Borrogo loam, 10 to 30 percent slopes-----	17	VIIe	62	-----	----	-----	3	H
CA	Calabasas loam, 0 to 10 percent slopes-----	18	VIe	62	-----	----	Loamy	-----	B
CB	Calabasas loam, 0 to 20 percent slopes, eroded-----	18	VIIe	62	-----	----	Loamy	-----	B
CC	Capillo gravelly sandy loam, 10 to 50 percent slopes-----	19	VIIe	62	-----	----	-----	2,5	G
CE	Capillo-Rock outcrop complex, 25 to 70 percent slopes-----	19	VIIIs	63	-----	----	-----	3,6	G
CG	Cerrillos fine sandy loam, 0 to 5 percent slopes-----	19	VIe	62	-----	----	Loamy	-----	B
CM	Chimayo stony loam, 30 to 60 percent slopes-----	20	VIIe	62	-----	----	Mountain Shale	-----	F
CO	Clovis loam, 1 to 3 percent slopes-----	21	VIe	62	IIe-1	59	Loamy	-----	E
CU	Cueva very stony clay, 20 to 60 percent slopes-----	21	VIIe	62	-----	----	Mountain Shale	-----	F
CV	Cundiyo gravelly sandy loam, 45 to 80 percent slopes-----	22	VIIe	62	-----	----	-----	2,5,8	G
DP	Dean-Pastura loams, 1 to 9 percent slopes-----	22	VIIIs	63	-----	----	Shallow	-----	A
EL	El Rancho-Fruitland complex-----	23	VIe	62	-----	----	-----	-----	A
	El Rancho sandy clay loam---	----	-----	----	-----	----	Loamy	-----	-----
	Fruitland sandy loam-----	----	-----	----	-----	----	Sandy	-----	-----
EN	Encierro stony fine sandy loam, 0 to 20 percent slopes-----	24	VIIe	62	-----	----	-----	3	F
FF	Fivemile loam-----	25	VIe	62	-----	----	Loamy	-----	C
FG	Fortwingate gravelly sandy loam, loamy subsoil variant, 30 to 60 percent slopes-----	26	VIIe	62	-----	----	-----	1,4,8	G
GG	Galisteo-Gullied land complex, level-----	27	VIIe	62	-----	----	Salt Flats	-----	E
GL	Guaje gravelly sandy loam, 10 to 30 percent slopes-----	28	VIIe	62	-----	----	-----	3	F
HA	Hagerman fine sandy loam, 0 to 5 percent slopes-----	28	VIe	62	-----	----	Loamy	-----	D
HC	Harvey loam, 1 to 9 percent slopes-----	29	VIe	62	-----	----	Loamy	-----	C
HD	Harvey-Dean loams, 1 to 9 percent slopes-----	29	VIe	62	-----	----	-----	-----	A
	Harvey loam-----	----	-----	----	-----	----	Loamy	-----	-----
	Dean loam-----	----	-----	----	-----	----	Shallow	-----	-----
HP	Harvey-Penistaja sandy loams, 0 to 5 percent slopes-----	30	VIe	62	-----	----	Sandy	-----	C



## GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	De- scribed on page	Dryland capability subclass		Irrigated capability unit		Range site Name	Timber suitability group Number	Wildlife habitat group Symbol
			Symbol	Page	Symbol	Page			
HR	Harvey-Cerrillos association, undulating-----	30	VIe	62	-----	----	Loamy	-----	B
LB	La Brier loam-----	30	VIew	62	Ilew-1	60	Bottomland	-----	C
LH	Laporte-Rock outcrop complex, 5 to 25 percent slopes-----	31	VIIIs	63	-----	----	Shallow	-----	F
LL	Las Lucas loam, 1 to 9 percent slopes-----	32	VIe	62	-----	----	Clayey	-----	C
LS	Los Alamos-Silver sandy loams, 0 to 10 percent slopes-----	33	VIe	62	-----	----	Loamy	-----	B
LU	Lunch peat, shallow variant----	33	VIIw	62	-----	----	-----	12	H
MA	Majada stony fine sandy loam, 20 to 50 percent slopes-----	34	VIIIs	63	-----	----	Malpais	-----	F
MC	McVickers sandy loam, kaolinitic variant-----	35	VIIe	62	-----	----	-----	1,4,8	G
MD	Mirabal stony loam, 5 to 30 percent slopes-----	35	VIIe	62	-----	----	-----	2,6	G
ME	Mirabal stony loam, 30 to 70 percent slopes-----	35	VIIe	62	-----	----	-----	3,6	G
MF	Mirabal-Rock outcrop complex, 40 to 100 percent slopes-----	35	VIIIs	63	-----	----	-----	3,6	G
MG	Montoso gravelly silt loam, 5 to 30 percent slopes-----	36	VIIe	62	-----	----	Cinder	-----	F
MH	Montoso gravelly silt loam, 30 to 60 percent slopes-----	36	VIIe	62	-----	----	Cinder	-----	F
MO	Moriarty silty clay-----	36	VIew	62	-----	----	Clayey	-----	E
NA	Nambe gravelly loam, 30 to 50 percent slopes-----	37	VIIe	62	-----	----	-----	10	G
NB	Nambe stony loam, 20 to 60 percent slopes-----	37	VIIe	62	-----	----	-----	5,8,11	G
NE	Nambe stony loam, 20 to 70 percent slopes, eroded-----	37	VIIe	62	-----	----	-----	11	G
NM	Nambe-Rock outcrop complex, 20 to 50 percent slopes-----	38	VIIIs	63	-----	----	-----	11	G
NR	Nambe-Rock outcrop complex, 50 to 100 percent slopes-----	38	VIIIs	63	-----	----	-----	12	G
OG	Ortiz gravelly loam, 5 to 40 percent slopes-----	38	VIIe	62	-----	----	Mountain Shale	-----	F
OP	Otero-Palma fine sandy loams, 1 to 9 percent slopes-----	39	VIe	62	-----	----	Sandy	-----	C
PB	Panky fine sandy loam-----	40	VIe	62	-----	----	Loamy	-----	B
PC	Pena stony clay loam, 1 to 25 percent slopes-----	41	VIIe	62	-----	----	Shallow	-----	F
PD	Penistaja fine sandy loam, 0 to 5 percent slopes-----	41	VIe	62	-----	----	Sandy	-----	C
PE	Penitente cobbly loam, 0 to 30 percent slopes-----	42	VIIe	62	-----	----	Alpine Slopes	-----	G
PH	Persayo-Shale rock land association, rolling-----	43	-----	----	-----	----	-----	-----	-----
	Persayo channery clay loam-----	----	VIIIs	63	-----	----	Shallow	-----	A
	Shale rock land-----	----	VIIIIs	64	-----	----	-----	-----	-----
PK	Pojoaque-Panky association, rolling-----	43	-----	----	-----	----	-----	-----	F
	Pojoaque sandy clay loam--	----	VIIe	62	-----	----	River Breaks	-----	-----
	Panky loam-----	----	VIe	62	-----	----	Loamy	-----	-----

## GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	De- scribed on page	Dryland capability subclass		Irrigated capability unit		Range site Name	Timber suitability group Number	Wildlife habitat group Symbol
			Symbol	Page	Symbol	Page			
PN	Pojoaque-Rough broken land complex-----	43	VIIe	62	-----	----	River Breaks	-----	F
PR	Prewitt loam-----	44	VIe	62	-----	----	Loamy	-----	E
RD	Rednun loam, 1 to 9 percent slopes-----	44	VIe	62	-----	----	Loamy	-----	B
RE	Rednun-Pena association, rolling-----	44	-----	----	-----	----	-----	-----	F
	Rednun loam-----	----	VIe	62	-----	----	Loamy	-----	-----
	Pena gravelly clay loam----	----	VIIe	62	-----	----	Shallow	-----	-----
RG	Rednun-Travessilla association, undulating-----	45	-----	----	-----	----	-----	-----	F
	Rednun loam-----	----	VIe	62	-----	----	Loamy	-----	-----
	Travessilla loam-----	----	VIIIs	63	-----	----	Shallow Sandstone	-----	-----
RH	Riverwash-----	45	VIIIw	63	-----	----	-----	-----	-----
RK	Rock outcrop-----	45	VIIIs	64	-----	----	-----	-----	-----
RL	Rock outcrop-Chimayo complex, 45 to 100 percent slopes----	45	VIIIs	63	-----	----	Mountain Shale	-----	F
RO	Rock slides-----	45	VIIIIs	64	-----	----	-----	-----	-----
RU	Rough broken land-----	45	VIIe	62	-----	----	River Breaks	-----	F
SF	Santa Fe-La Fonda association, hilly-----	46	-----	----	-----	----	-----	-----	F
	Santa Fe clay loam-----	----	VIIIs	63	-----	----	Hills	-----	-----
	La Fonda loam-----	----	VIe	62	-----	----	Loamy	-----	-----
SM	Santa Fe-Rock outcrop complex, 5 to 25 percent slopes-----	46	VIIIs	63	-----	----	Hills	-----	F
SP	Silver-Pojoaque association, undulating-----	47	-----	----	-----	----	-----	-----	F
	Silver loam-----	----	VIe	62	-----	----	Loamy	-----	-----
	Pojoaque clay loam-----	----	VIIe	62	-----	----	River Breaks	-----	-----
SR	Silver loam, 0 to 10 percent slopes-----	47	VIe	62	-----	----	Loamy	-----	B
ST	Stony rock land-----	47	VIIIs	63	-----	----	Hills	-----	F
SU	Supervisor gravelly sandy loam, 15 to 60 percent slopes-----	48	VIIe	62	-----	----	-----	2,5	G
SV	Supervisor-Rock outcrop complex, 45 to 100 percent slopes----	48	VIIIs	63	-----	----	-----	3,6	G
TA	Tapia-Dean loams, 1 to 5 percent slopes-----	48	VIe	62	-----	----	-----	-----	A
	Tapia loam-----	----	-----	----	-----	----	Loamy	-----	-----
	Dean loam-----	----	-----	----	-----	----	Shallow	-----	-----
TB	Travessilla-Bernal fine sandy loams-----	49	VIIIs	63	-----	----	-----	-----	F
	Travessilla fine sandy loam-----	----	-----	----	-----	----	Shallow Sandstone	-----	-----
	Bernal fine sandy loam-----	----	-----	----	-----	----	Loamy	-----	-----
TR	Travessilla-Rock outcrop complex, 1 to 25 percent slopes-----	49	VIIIs	63	-----	----	Shallow Sandstone	-----	F
TU	Tuff rock land-----	49	VIIIIs	64	-----	----	-----	-----	F

## GUIDE TO MAPPING UNITS---Continued

Map symbol	Mapping unit	De- scribed on page	Dryland capability subclass		Irrigated capability unit		Range site  Name	Timber suitability group  Number	Wildlife habitat group  Symbol
			Symbol	Page	Symbol	Page			
WC	Wilcoxson sandy clay loam, soft bedrock variant, 15 to 40 percent slopes-----	50	VIIe	62	-----	----	-----	2,5	H
WL	Willard loam-----	50	VIe	62	IIIs-1	61	Loamy	-----	E
WN	Witt loam-----	51	VIe	62	Ile-1	59	Loamy	-----	E
ZU	Zuni loam, brown subsoil variant, 10 to 40 percent slopes-----	52	VIIe	62	-----	----	-----	1,4	G

1/

The composition of the mapping units in the low intensity survey is more variable than that in the high intensity survey, but it has been controlled well enough to interpret for the expected use of the soils.

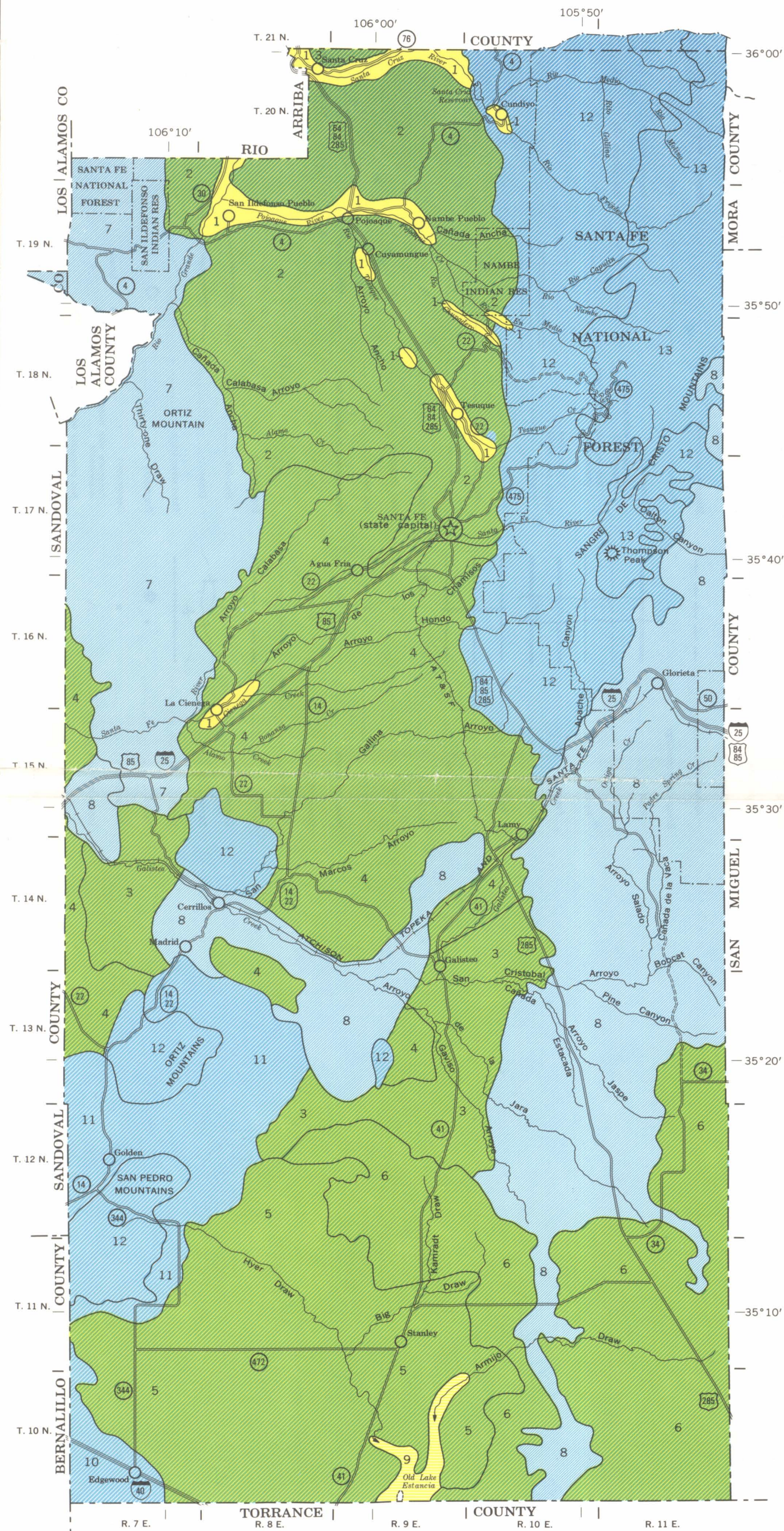
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SOIL ASSOCIATIONS \*

SOILS OF RECENT ALLUVIAL VALLEYS

- 1 El Rancho-Fruitland association: Level to gently sloping, deep, loamy soils; on terraces and alluvial fans

SOILS OF DISSECTED PIEDMONT PLAINS

- 2 Pojoaque-Rough broken land association: Moderately sloping to moderately steep, deep, loamy and gravelly soils; on upland terraces and Rough broken land
- 3 Las Lucas-Pojoaque association: Nearly level to hilly, deep, loamy and gravelly soils; on uplands and dissected, eroded terraces
- 4 Panky-Pojoaque-Harvey association: Level to hilly, deep, loamy to clayey soils; on old alluvial fans and dissected, eroded terraces
- 5 Witt-Harvey-Clovis association: Level to moderately sloping, deep, loamy soils; on old alluvial fans in uplands of the Estancia Valley
- 6 Harvey-Dean-Tapia association: Nearly level to moderately sloping, loamy soils that are shallow to soft caliche and deep, loamy soils; on uplands

SOILS OF MESAS, CINDER CONES, AND BASALT FLOWS

- 7 Majada-Calabasas-Apache association: Level to steep, deep to shallow, loamy and very cobbly soils; on old basalt flows and cinder cones
- 8 Travessilla-Rock outcrop-Bernal association: Nearly level to moderately steep, shallow to very shallow, loamy soils and Rock outcrop; on mesas

SOILS OF OLD LAKE BASINS

- 9 La Brier-Willard association: Level to nearly level, deep, loamy to clayey soils; on alluvial fans and old lake benches

SOILS OF THE SANGRE DE CRISTO AND ORTIZ MOUNTAINS AND FOOTHILLS

- 10 Laporte-Witt association: Level to moderately steep, shallow to deep, loamy soils; on low foothills and alluvial fans
- 11 Rednun-Pena-Stony rock land association: Nearly level to moderately steep, deep, loamy to clayey and very gravelly soils; on uplands and alluvial fans; and steep to very steep, stony rock land; on foothills and mountain foot slopes
- 12 Chimayo-Mirabal-Supervisor association: Moderately sloping to very steep, shallow to moderately deep, loamy and very gravelly or very stony soils; on mountain foot slopes
- 13 Nambe-Cundiyo association: Moderately steep to very steep, deep, loamy and very cobbly or very stony soils; on mountains

\*Texture terms used in descriptive heading of an association refer to dominant texture of the subsoil or texture of a significant thickness of soil material below the surface layer.

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U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
FOREST SERVICE  
U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF INDIAN AFFAIRS  
NEW MEXICO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP  
SANTA FE AREA, NEW MEXICO



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.







SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey; it is a small letter if the mapping unit is one of the high intensity.

SYMBOL		NAME	SYMBOL		NAME	SYMBOL		NAME
High Intensity	Low Intensity		High Intensity	Low Intensity		High Intensity	Low Intensity	
-	AD	Adel loam, 5 to 35 percent slopes	Fe	FF	Fivemile loam	-	OG	Ortiz gravelly loam, 5 to 40 percent slopes
-	AF	Agua Fria fine sandy loam	-	FG	Fortwingate gravelly sandy loam, loamy subsoil variant, 30 to 60 percent slopes	-	OP	Otero-Palma fine sandy loams, 1 to 9 percent slopes
-	AG	Alluvial land, gravelly				Pa	PB	Panky fine sandy loam
-	AL	Alluvial land, cobbly	Fn	-	Fruitland sandy loam, 0 to 3 percent slopes	-	PC	Pena stony clay loam, 1 to 25 percent slopes
-	AM	Alluvial land, saline	Fr	-	Fruitland sandy loam, 3 to 5 percent slopes	-	PD	Penistaja fine sandy loam, 0 to 5 percent slopes
An	-	Ancho clay loam	Fs	-	Fruitland sandy loam, saline, 0 to 3 percent slopes	-	PE	Penitente cobbly loam, 0 to 30 percent slopes
Ao	-	Ancho clay loam, saline	Ft	-	Fruitland sandy clay loam, 0 to 3 percent slopes	-	PH	Persayo-Shale rock land association, rolling
-	AP	Apache stony fine sandy loam, 1 to 15 percent slopes	-	GG	Gallisteo-Gullied land complex, level	-	PK	Pojoaque-Panky association, rolling
-	BA	Badland	-	GL	Guaje gravelly sandy loam, 10 to 30 percent slopes	Pm	PN	Pojoaque-Rough broken land complex
-	BD	Basalt rock land	-			-	PR	Prewitt loam
Be	-	Bluewing loamy fine sand	-	HA	Hagerman fine sandy loam, 0 to 5 percent slopes	-	RD	Rednun loam, 1 to 9 percent slopes
Bf	-	Bluewing loamy fine sand, saline	-	HC	Harvey loam, 1 to 9 percent slopes	-	RE	Rednun-Pena association, rolling
Bg	BH	Bluewing gravelly sandy loam	-	HD	Harvey-Dean loams, 1 to 9 percent slopes	-	RG	Rednun-Travessilla association, undulating
-	BM	Bobtail loam, 20 to 70 percent slopes	-	HP	Harvey-Penistaja sandy loams, 0 to 5 percent slopes	-	RH	Riverwash
-	BO	Bobtail-Rock outcrop complex, 40 to 90 percent slopes	-	HR	Harvey-Cerrillos association, undulating	-	RK	Rock outcrop
-	BR	Borrogo loam, 10 to 30 percent slopes	-	LB	La Brier loam	-	RL	Rock outcrop-Chimaya complex, 45 to 100 percent slopes
-	CA	Calabasas loam, 0 to 10 percent slopes	Lf	-	La Fonda loam, 3 to 10 percent slopes	-	RO	Rock slides
-	CB	Calabasas loam, 0 to 20 percent slopes, eroded	Lg	LH	Laporte-Rock outcrop complex, 5 to 25 percent slopes	-	RU	Rough broken land
-	CC	Capilla gravelly sandy loam, 10 to 50 percent slopes	-	LL	Las Lucas loam, 1 to 9 percent slopes	-	SF	Santa Fe-La Fonda association, hilly
-	CE	Capilla-Rock outcrop complex, 25 to 70 percent slopes	-	LS	Los Alamos-Silver sandy loams, 0 to 10 percent slopes	Sk	SM	Santa Fe-Rock outcrop complex, 5 to 25 percent slopes
Cf	CG	Cerrillos fine sandy loam, 0 to 5 percent slopes	-	LU	Lunch peat, shallow variant	-	SP	Silver-Pojoaque association, undulating
Ch	-	Cerrillos fine sandy loam, 5 to 10 percent slopes	-	MA	Majada stony fine sandy loam, 20 to 50 percent slopes	-	SR	Silver loam, 0 to 10 percent slopes
-	CM	Chimaya stony loam, 30 to 60 percent slopes	-	MC	McVickers sandy loam, kaolinitic variant	-	ST	Stony rock land
-	CO	Clovis loam, 1 to 3 percent slopes	-	MD	Mirabal stony loam, 5 to 30 percent slopes	-	SU	Supervisor gravelly sandy loam, 15 to 60 percent slopes
-	CU	Cueva very stony clay, 20 to 60 percent slopes	-	ME	Mirabal stony loam, 30 to 70 percent slopes	-	SV	Supervisor-Rock outcrop complex, 45 to 100 percent slopes
-	CV	Cundiya gravelly sandy loam, 45 to 80 percent slopes	-	MF	Mirabal-Rock outcrop complex, 40 to 100 percent slopes	-	TA	Tapia-Dean loams, 1 to 5 percent slopes
-	DP	Dean-Pastura loams, 1 to 9 percent slopes	-	MG	Montoso gravelly silt loam, 5 to 30 percent slopes	-	TB	Travessilla-Bernal fine sandy loams
Ec	-	El Rancho sandy clay loam, 0 to 1 percent slopes	-	MH	Montoso gravelly silt loam, 30 to 60 percent slopes	-	TR	Travessilla-Rock outcrop complex, 1 to 25 percent slopes
Ed	-	El Rancho sandy clay loam, 1 to 3 percent slopes	-	MO	Moriarty silty clay	-	TU	Tuff rock land
Ee	-	El Rancho sandy clay loam, 3 to 5 percent slopes	-	NA	Nambe gravelly loam, 30 to 50 percent slopes	-	WC	Wilcoxson sandy clay loam, soft bedrock variant, 15 to 40 percent slopes
Eh	-	El Rancho sandy clay loam, sandy subsoil variant	-	NB	Nambe stony loam, 20 to 60 percent slopes	-	WL	Willard loam
-	EL	El Rancho-Fruitland complex	-	NE	Nambe stony loam, 20 to 70 percent slopes, eroded	-	WM	Witt loam
-	EN	Encierro stony fine sandy loam, 0 to 20 percent slopes	-	NM	Nambe-Rock outcrop complex, 20 to 50 percent slopes	-	ZU	Zuni loam, brown subsoil variant, 10 to 40 percent slopes
			-	NR	Nambe-Rock outcrop complex, 50 to 100 percent slopes			

# SANTA FE AREA, NEW MEXICO

## CONVENTIONAL SIGNS

### WORKS AND STRUCTURES

#### Highways and roads

Divided .....	
Good motor .....	
Poor motor .....	
Trail .....	

#### Highway markers

National Interstate .....	
U. S. ....	
State or county .....	

#### Railroads

Single track .....	
Multiple track .....	
Abandoned .....	

#### Bridges and crossings

Road .....	
Trail .....	
Railroad .....	
Ferry .....	
Ford .....	
Grade .....	
R. R. over .....	
R. R. under .....	

#### Buildings

School .....	
Church .....	
Mine and quarry .....	
Gravel pit .....	

#### Power line

Pipeline .....	
----------------	--

#### Cemetery

Dams .....	
------------	--

#### Levee

Tanks .....	
-------------	--

#### Airway beacon

Indian mound and ruins .....	
------------------------------	--

#### Windmill

Located object .....	
----------------------	--

### BOUNDARIES

National or state .....	
County .....	
Soil survey .....	
Reservation .....	
Land grant .....	
Small park, cemetery, airport ...	
Land survey division corners ...	

### DRAINAGE

#### Streams, double-line

Perennial .....	
Intermittent .....	

#### Streams, single-line

Perennial .....	
Intermittent .....	
Crossable with tillage implements .....	
Not crossable with tillage implements .....	
Unclassified .....	
Canals and ditches, irrigation .....	

#### Lakes and ponds

Perennial .....	
Intermittent .....	

#### Spring

Well, irrigation .....	
------------------------	--

#### Wet spot

Drainage end or alluvial fan ...	
----------------------------------	--

### RELIEF

#### Escarpsments

Bedrock .....	
Other .....	

#### Short steep slope

Prominent peak .....	
----------------------	--

#### Depressions

Crossable with tillage implements .....	Large	Small
Not crossable with tillage implements .....		
Contains water most of the time .....		

### SOIL SURVEY DATA

#### Soil boundary

and symbol .....

Gravel .....

Stoniness { Stony .....  
Very stony .....

Rock outcrops .....

Chert fragments .....

Clay spot .....

Sand spot .....

Gumbo or scabby spot .....

Made land .....

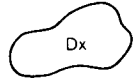
Severely eroded spot .....

Blowout, wind erosion .....

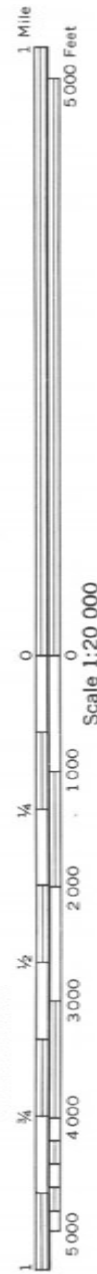
Gully .....

Kitchen midden .....

Soil sample site .....



655 000 FEET

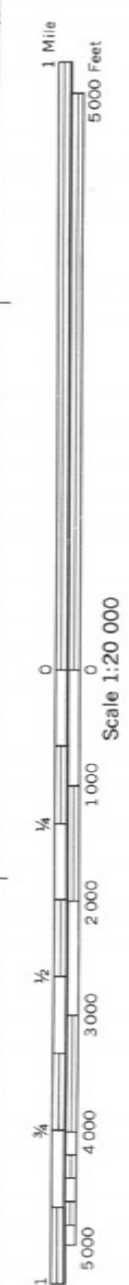
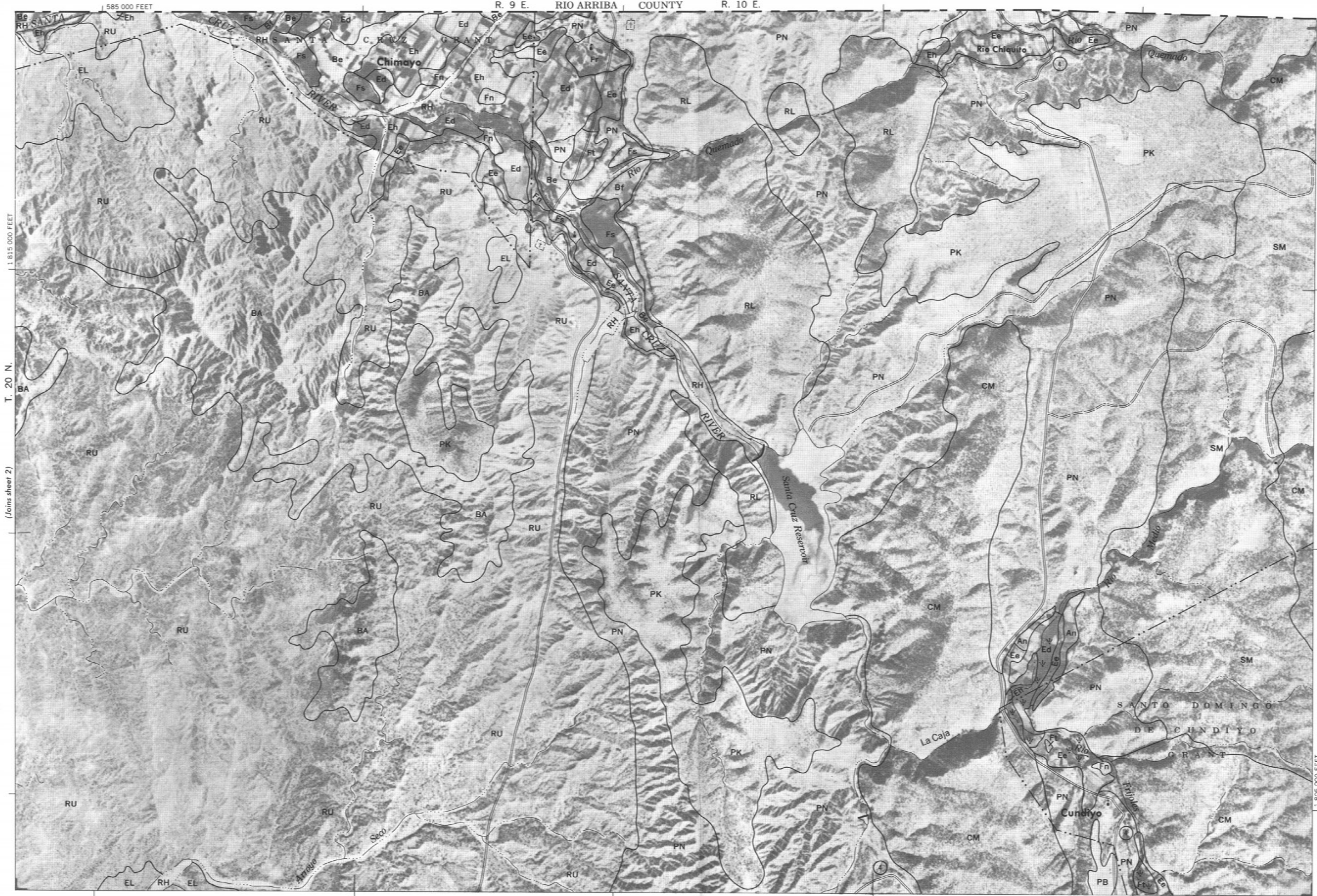






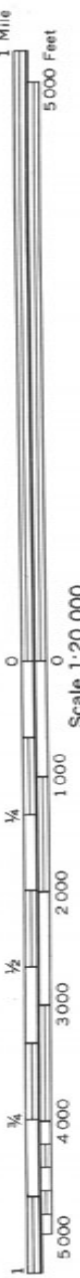
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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(Joins inset, sheet 6)



610 000 FEET (Joins sheet 10)

(Joins sheet 5)

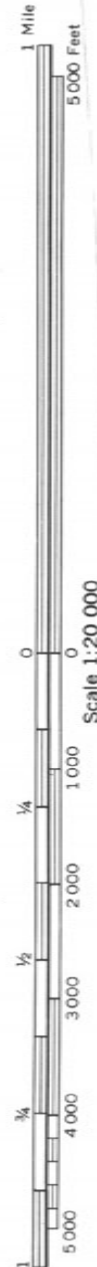
T. 20 N.

1 820 000 FEET

Photobase from 1963-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
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SANTA FE AREA, NEW MEXICO NO. 5



(Joins sheet 11)

655 000 FEET



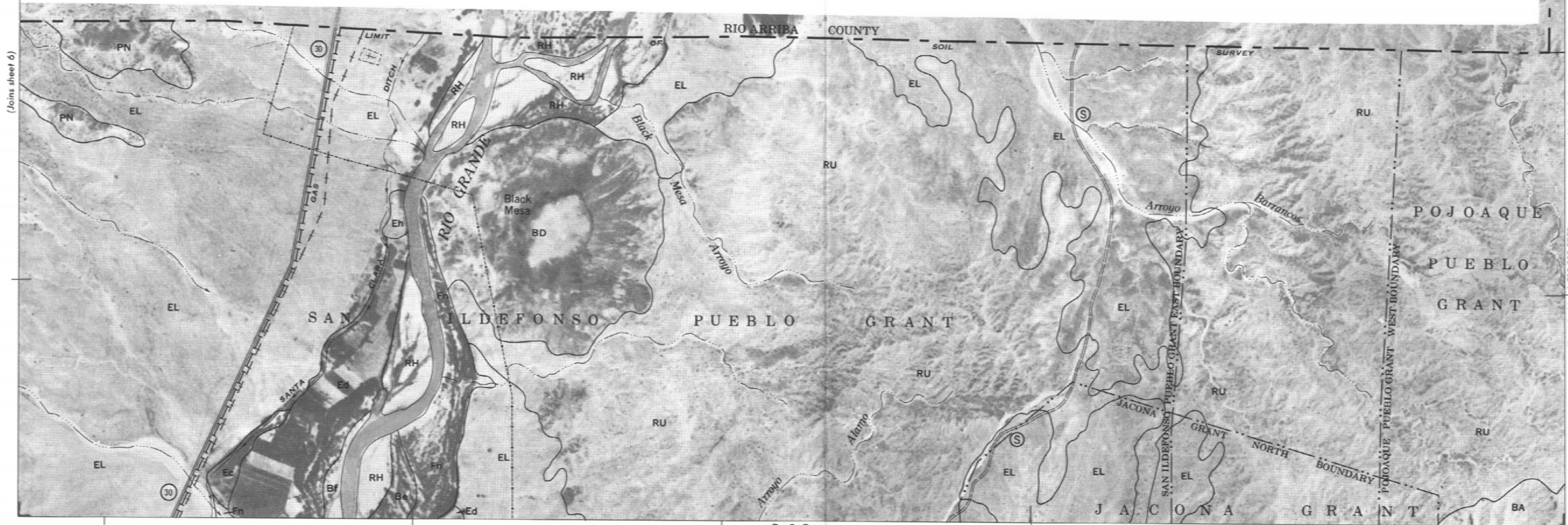




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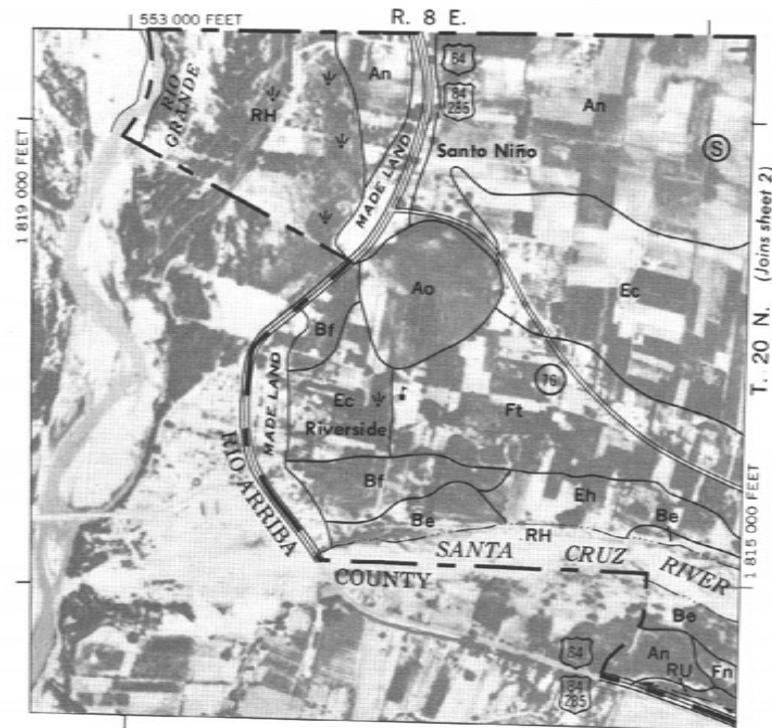


1 800 000 FEET



(Joins sheet 6)

(Joins sheet 8)



4 000 AND 5 000-FOOT GRID TICKS

(Joins sheet 14)

1 555 000 FEET







1 Mile  
5000 Feet

Scale 1:20 000

0 1000 2000 3000 4000 5000

1 1/4 1/2 3/4 1/8 1/16



1 800 000 FEET

(Joins sheet 9)

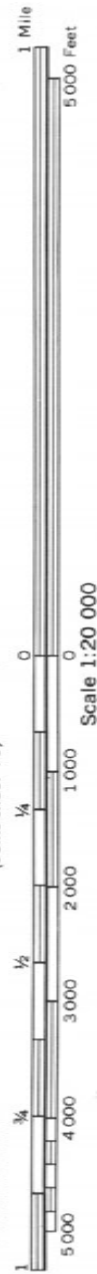
T. 20 N.

T. 19 N.

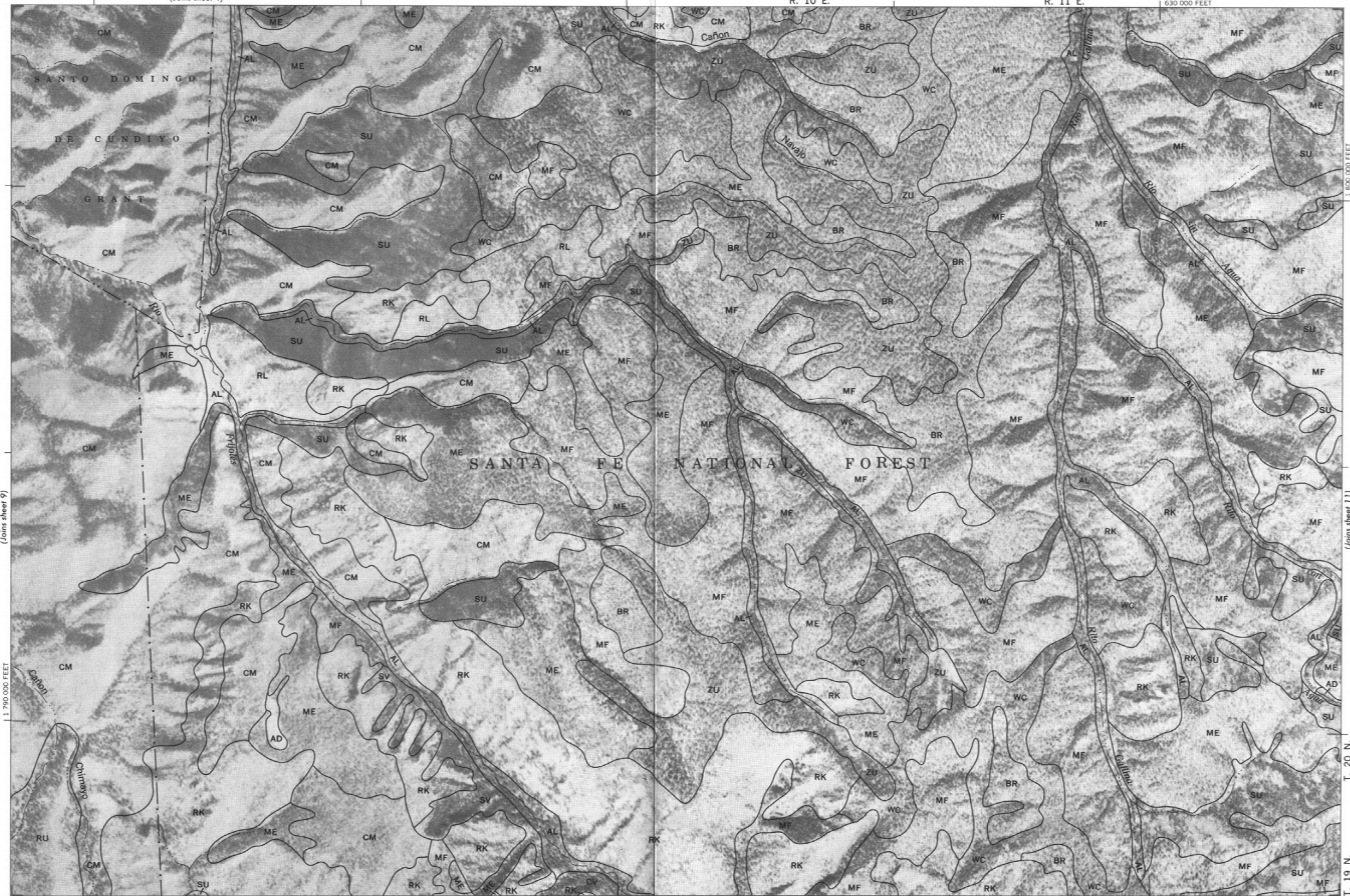
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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(Joins sheet 11)

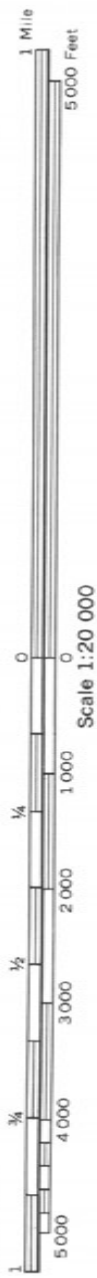
T. 20 N.

T. 19 N.

Photobase from 1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum. the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

SANTA FE AREA, NEW MEXICO NO. 10





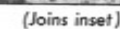
SANTA FE AREA, NEW MEXICO NO. 11

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 10)

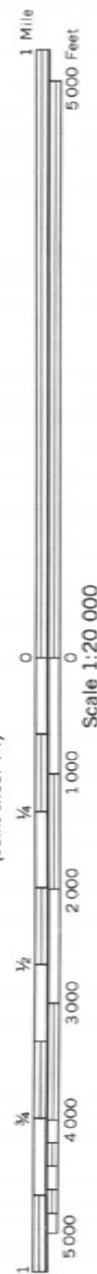
(Joins sheet 18)





SANTA FE AREA, NEW MEXICO NO. 12







(Joins sheet 7)

555 000 FEET



1 770 000 FEET

535 000 FEET

(Joins sheet 20)

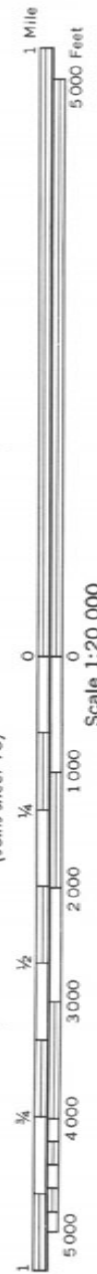
(Joins sheet 15)

T. 19 N.

555 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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SANTA FE AREA, NEW MEXICO NO. 15

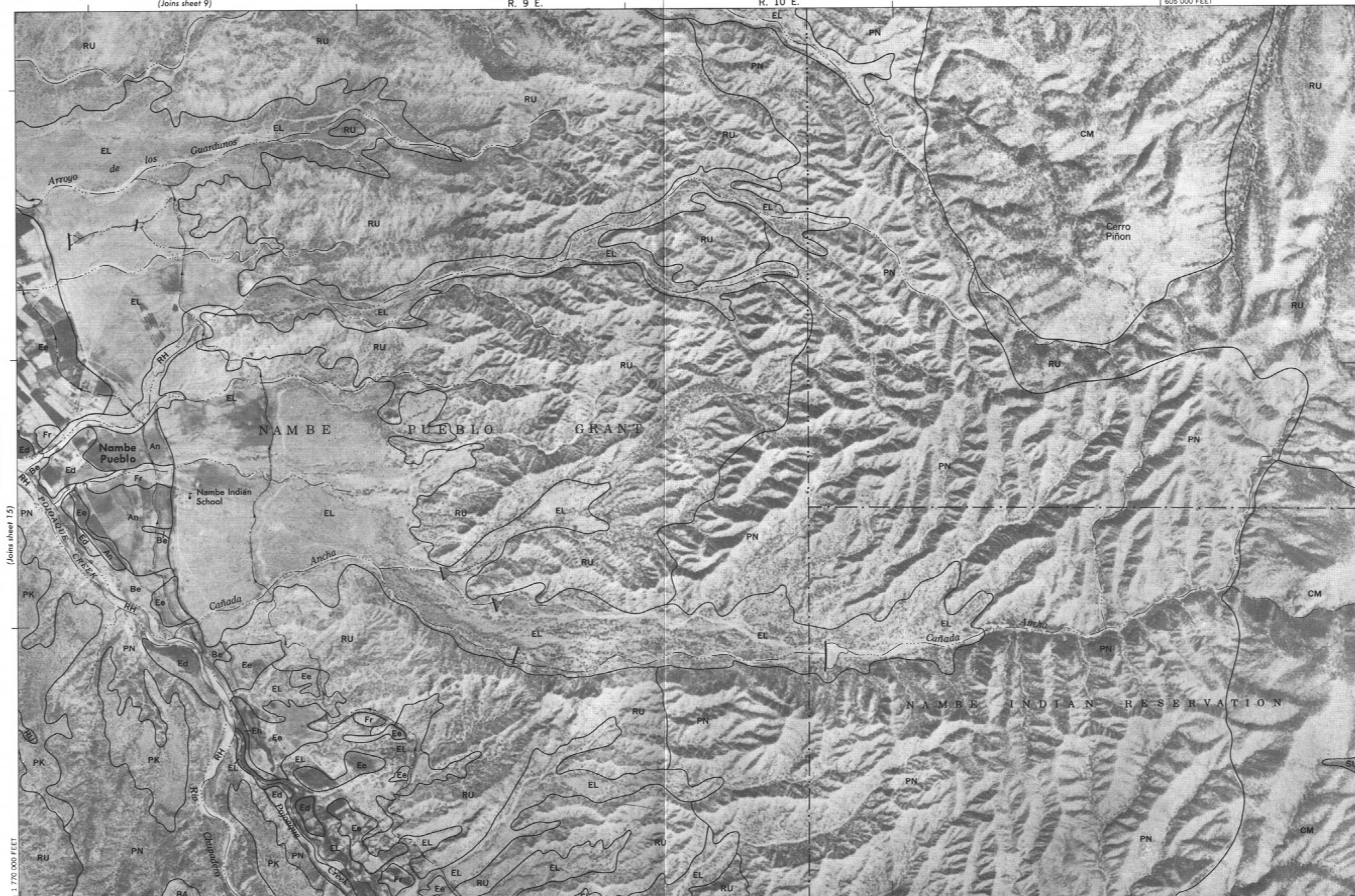
(Joins sheet 14)

(Joins sheet 8)

(Joins sheet 16)

(Joins sheet 21)



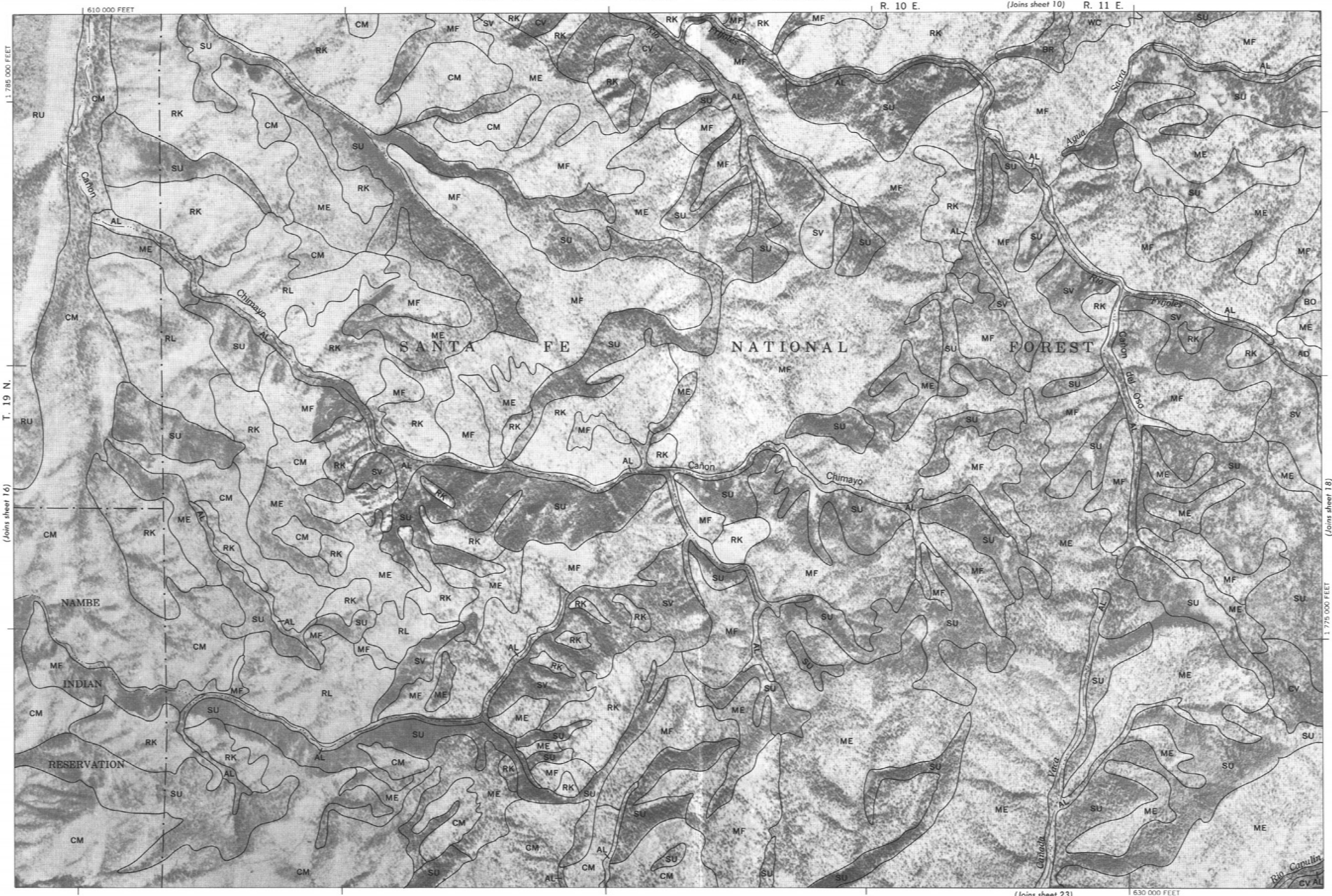


Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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Scale 1:20 000

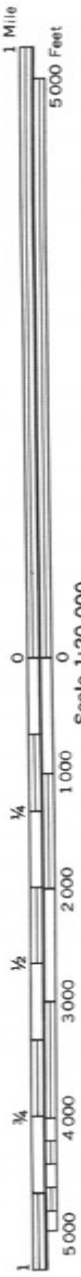


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SANTA FE AREA, NEW MEXICO NO. 17



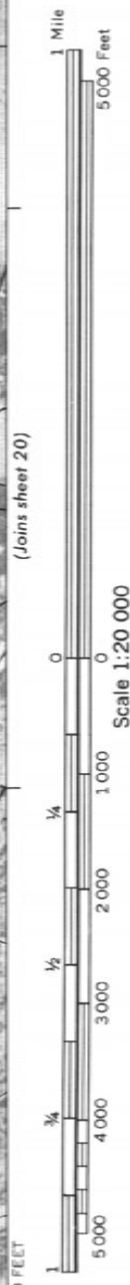
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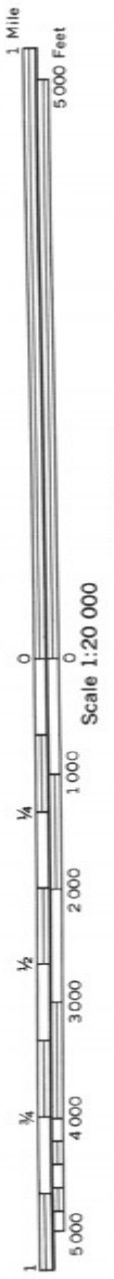
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
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SANTA FE AREA, NEW MEXICO, NO. 18









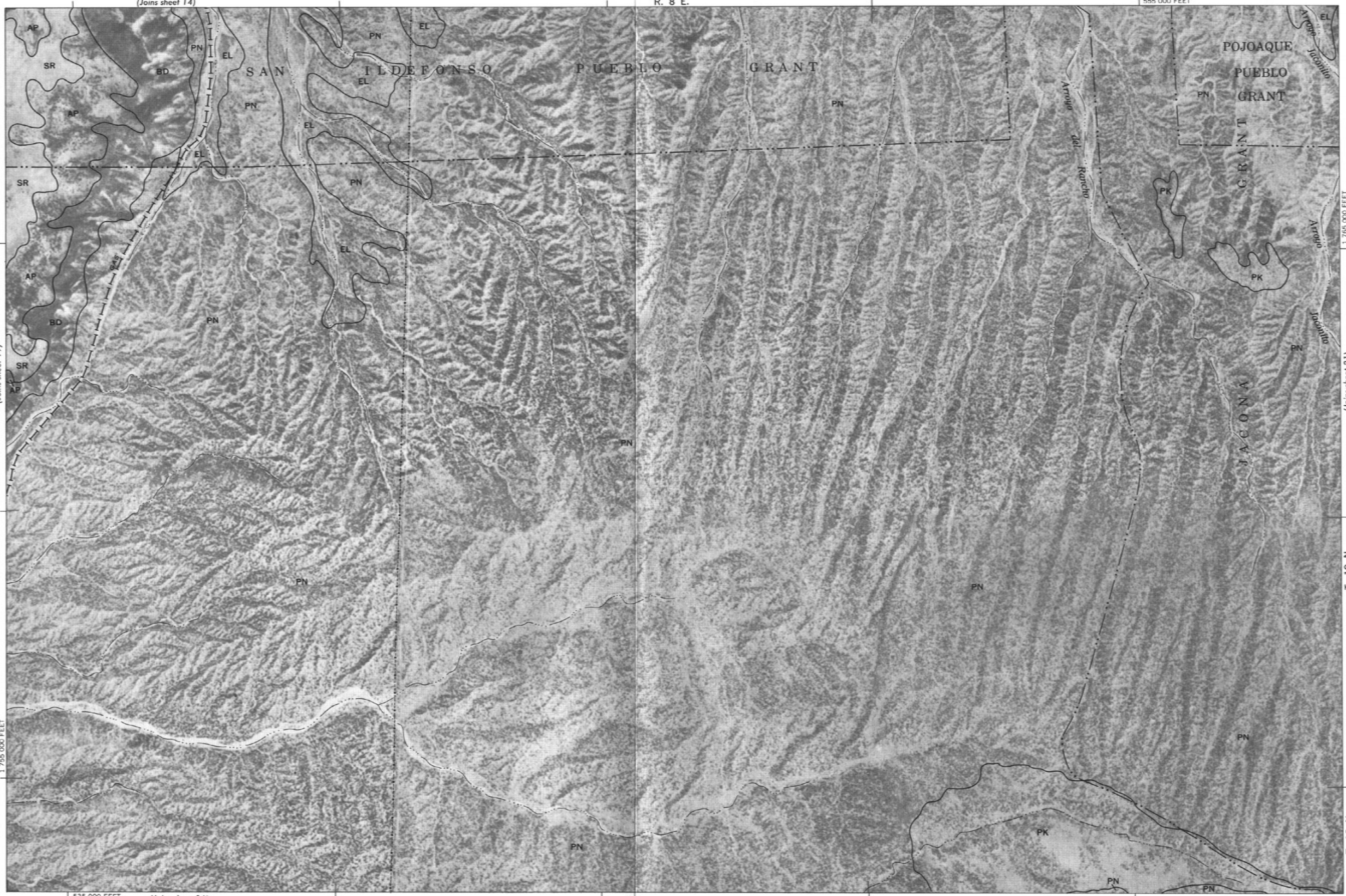
Scale 1:20 000

(Joins sheet 19)

1 755 000 FEET

535 000 FEET

(Joins sheet 26)



(Joins sheet 21)

1 765 000 FEET

T. 19 N.

T. 18 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





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T. 18 N. (Joins sheet 20) T. 19 N. (Joins sheet 22)

1 Mile  
5,000 Feet  
Scale 1:20,000

(Joins sheet 27) 580 000 FEET





1 Mile  
5,000 Feet

Scale 1:20 000  
0 1 000 2 000 3 000 4 000 5 000  
1/4 1/2 3/4

(Joins sheet 21)

1 755 000 FEET

(Joins sheet 28)



(Joins sheet 23)

T. 19 N.

T. 18 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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SANTA FE AREA, NEW MEXICO, NO. 22



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(Joins sheet 22)

T. 19 N.

T. 18 N.

(Joins sheet 24)

1 765 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 29)

630 000 FEET



(Joins sheet 18)

655 000 FEET



1 770 000 FEET

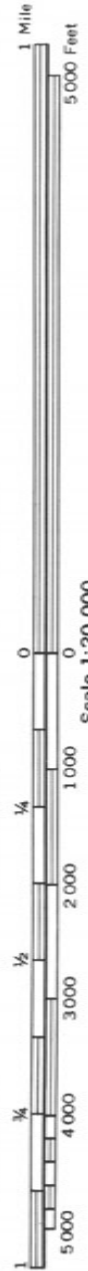
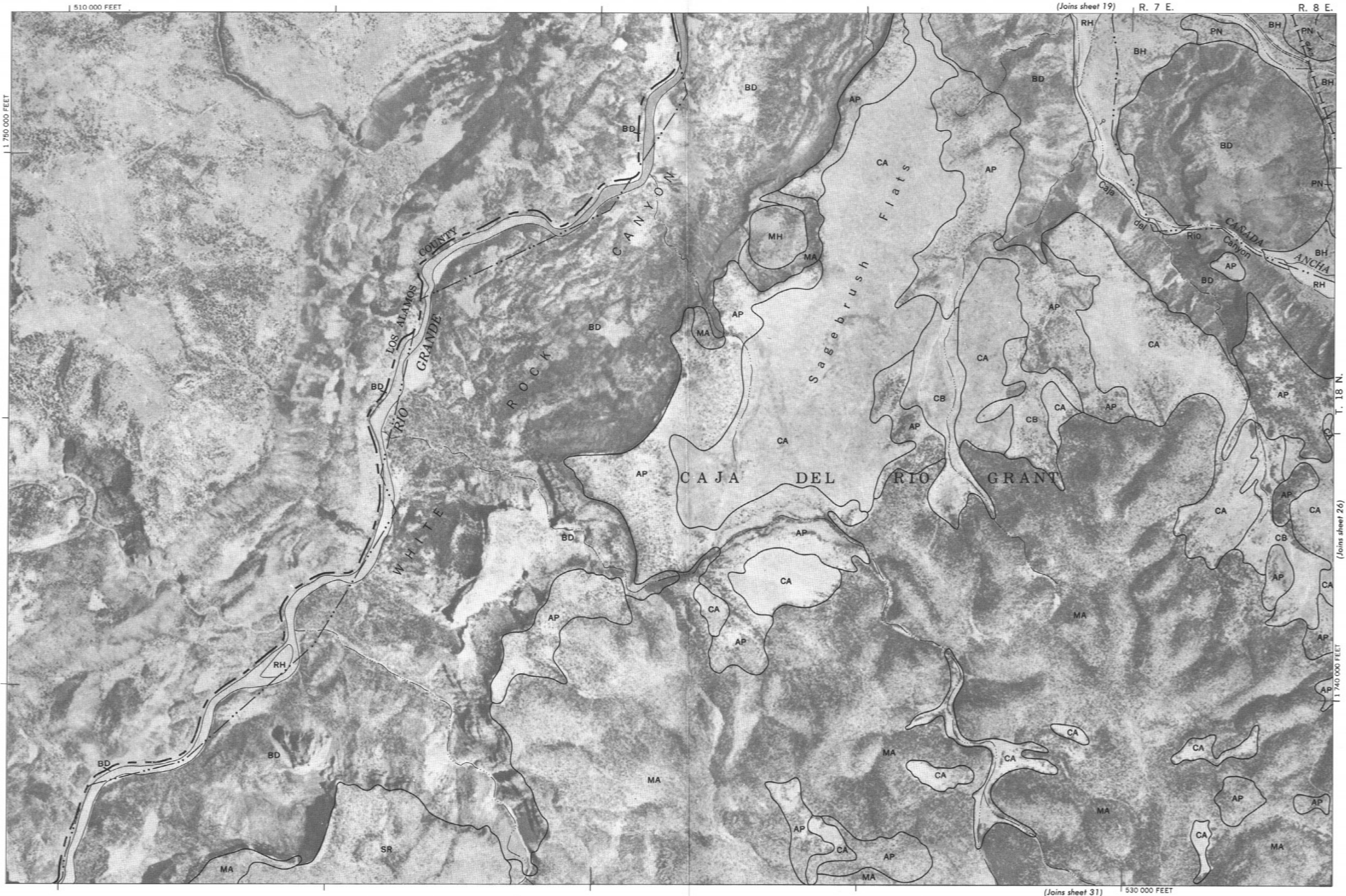
635 000 FEET

(Joins sheet 30)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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(Joins sheet 20)

R. 8 E.



(Joins sheet 25)

(Joins sheet 27)

535 000 FEET (Joins sheet 32)

555 000 FEET

1 750 000 FEET

Photobase from 1963-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
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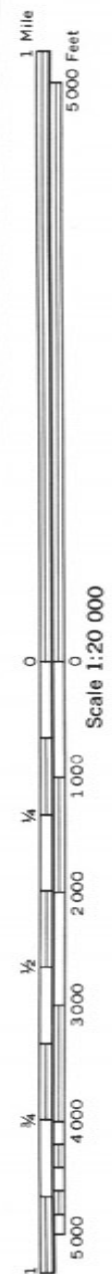


(Joins sheet 22)

R. 9 E.

R. 10 E.

1 605 000 FEET



(Joins sheet 27)

1 740 000 FEET

585 000 FEET (Joins sheet 34)



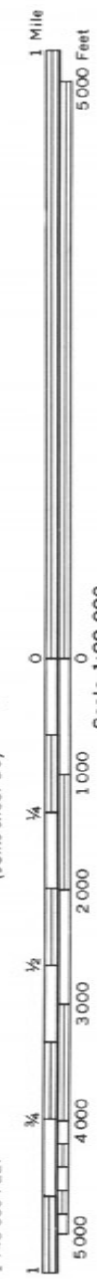
(Joins sheet 29)

T. 18 N.

1 750 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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SANTA FE AREA, NEW MEXICO NO. 29.

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(Joins sheet 28)

T. 18 N.

1 750 000 FEET

(Joins sheet 35)

630 000 FEET



Scale 1:20 000

(Joins sheet 29)

11 740 000 FEET

635 000 FEET

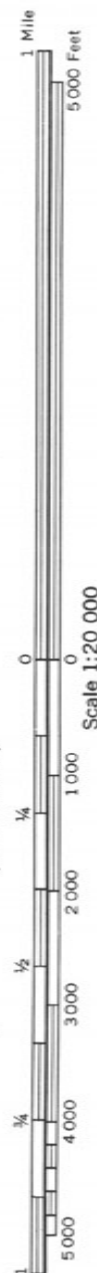
(Joins sheet 36)

T. 18 N. | T. 19 N.

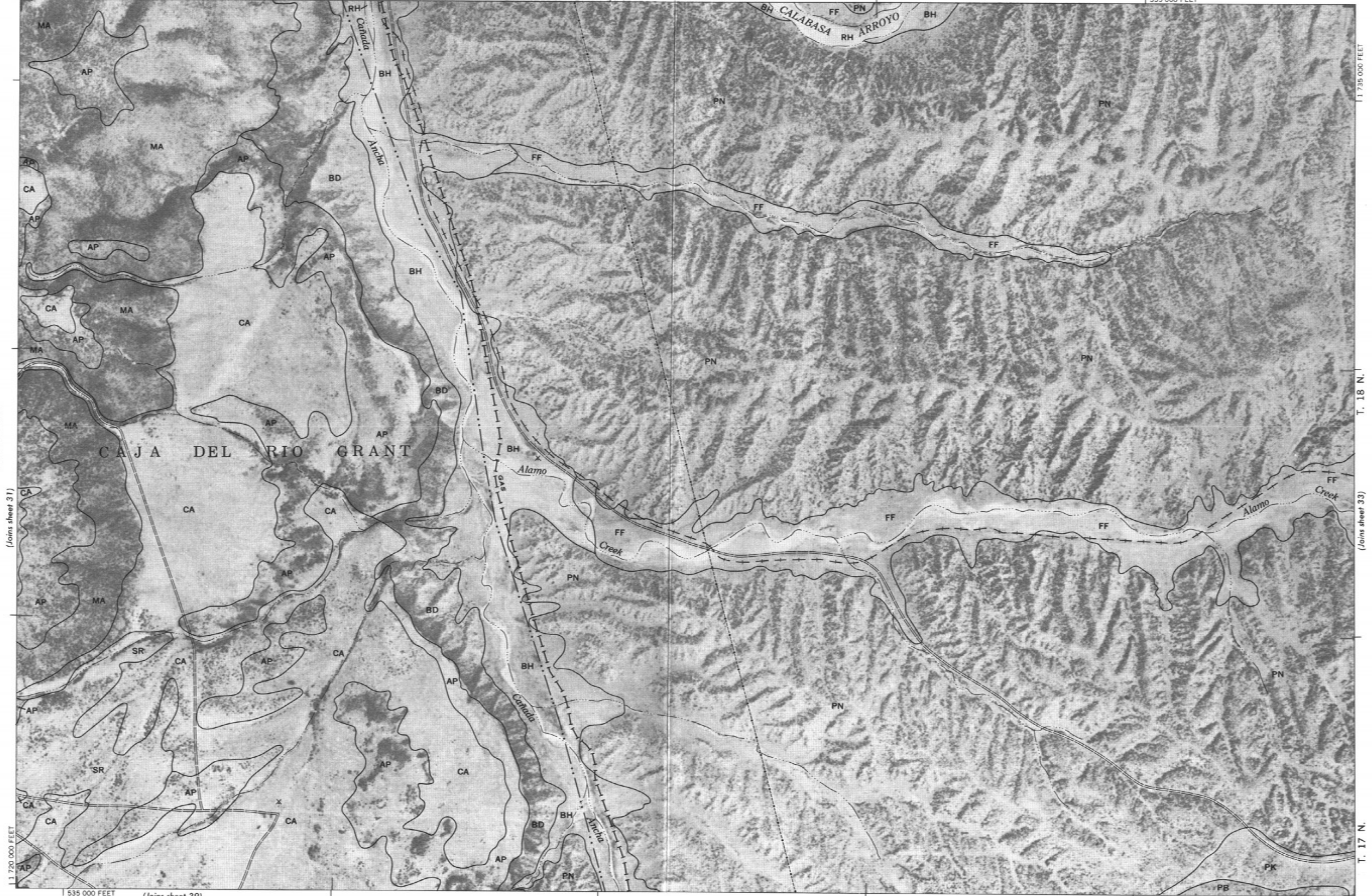
Photobase from 1963-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

SANTA FE AREA, NEW MEXICO NO. 30





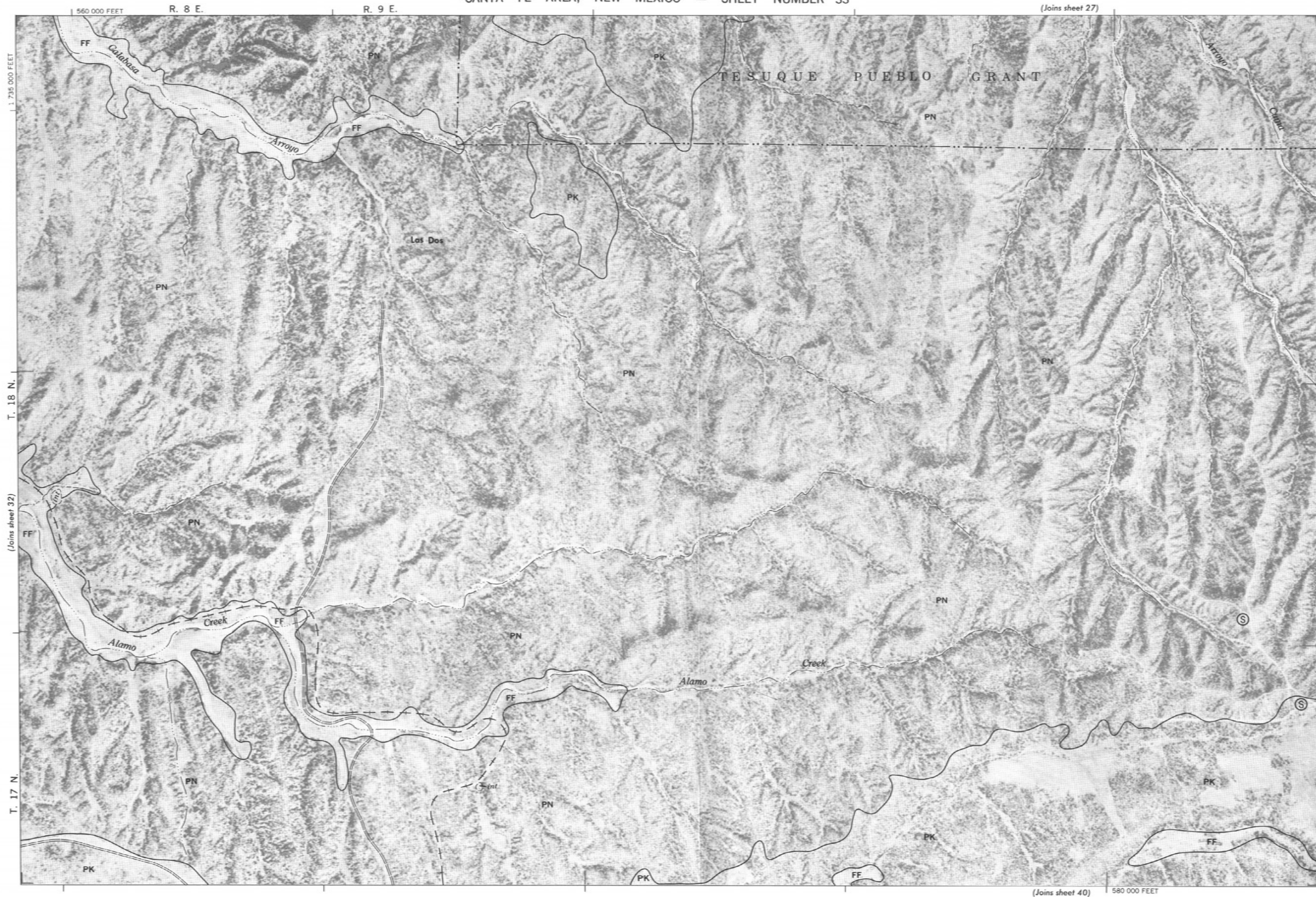




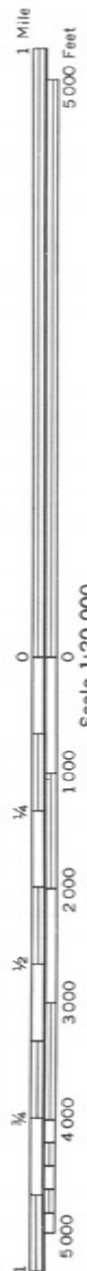
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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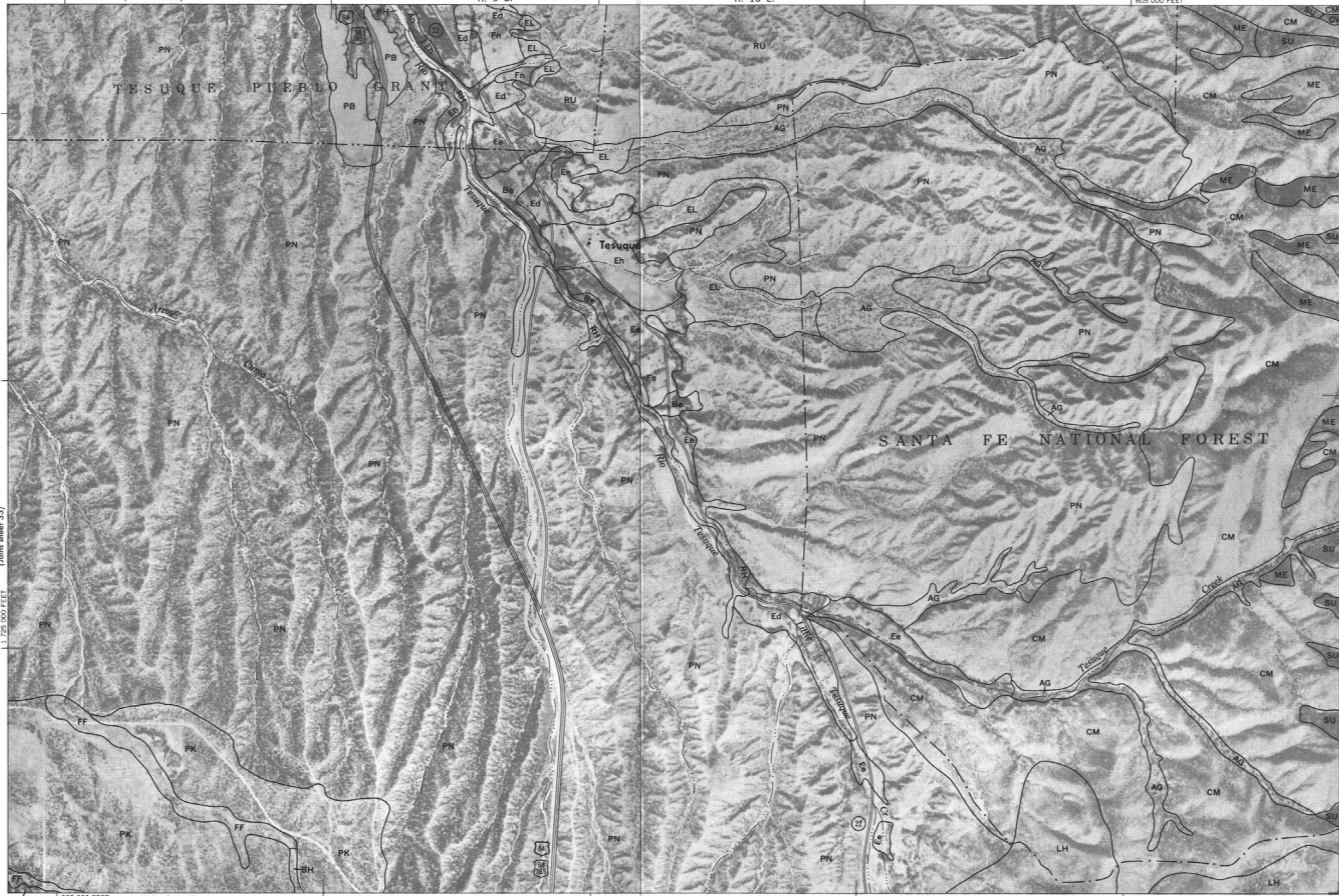


(Joins sheet 32) (Joins sheet 34)



Scale 1:20 000





(Joins sheet 35)

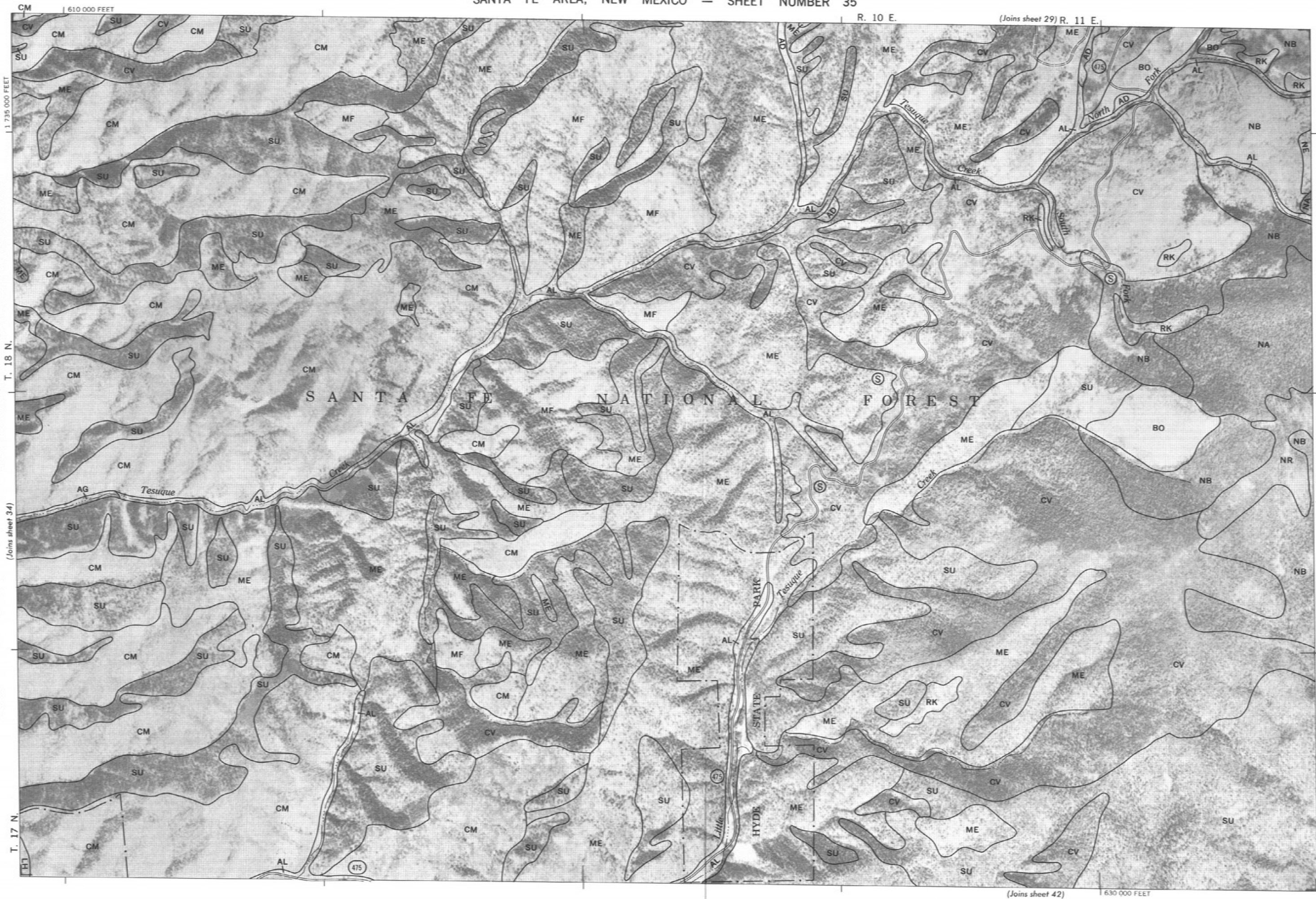
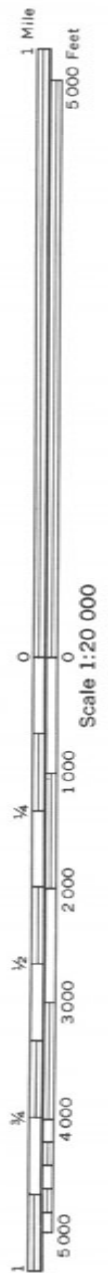
T. 18 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.

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SANTA FE AREA, NEW MEXICO NO. 34





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(Joins sheet 34)

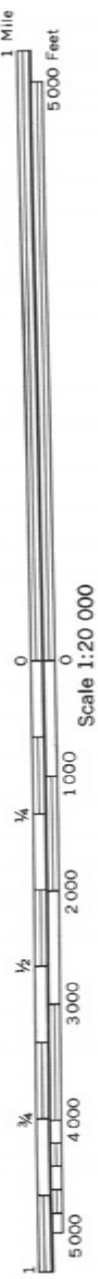
(Joins sheet 36)

(Joins sheet 42)





(Joins sheet 30)



T. 18 N.

T. 17 N.



635 000 FEET

(Joins sheet 43)

1 735 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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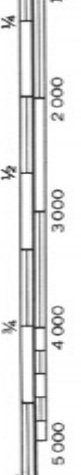




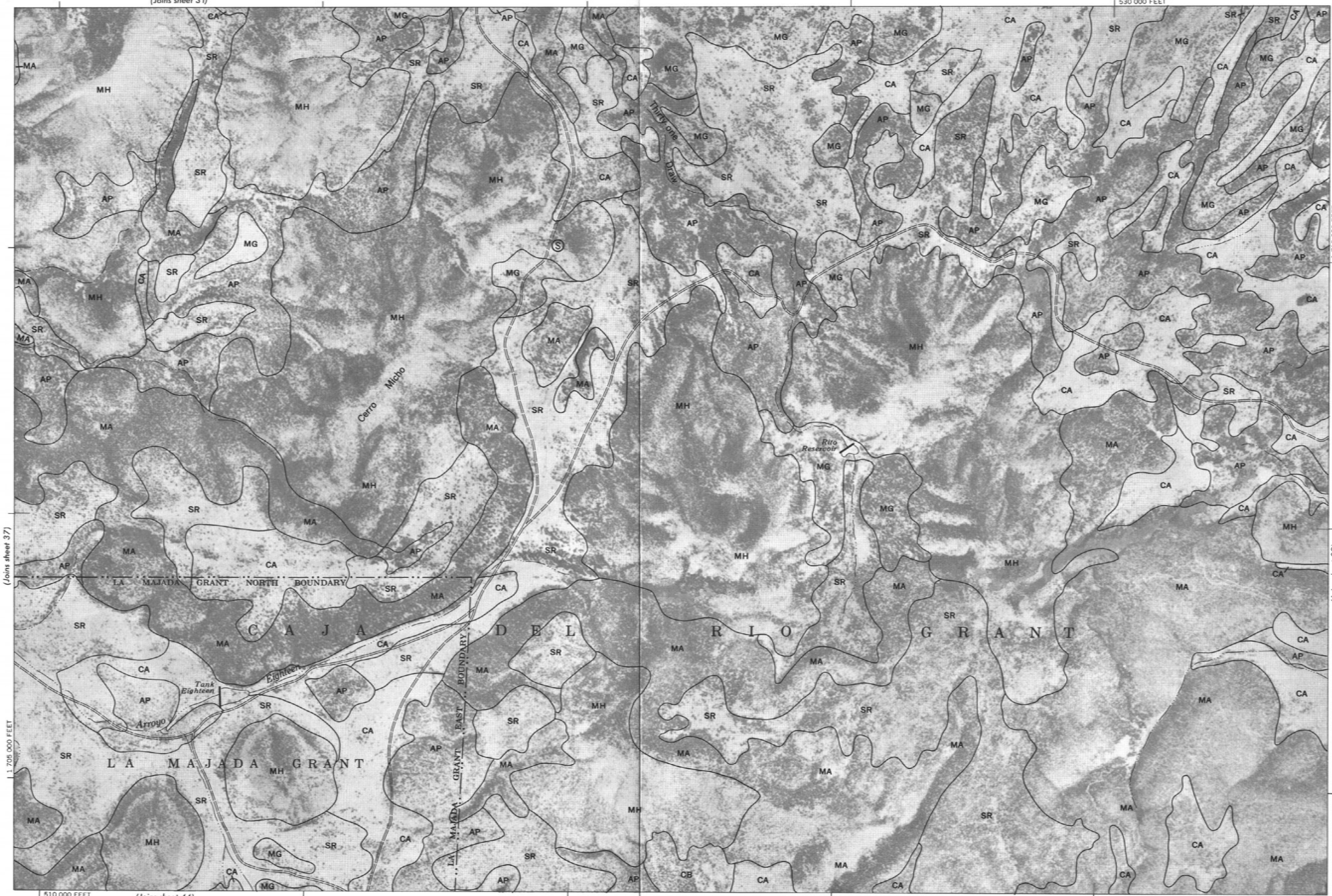


1 Mile  
5 000 Feet

Scale 1:20 000



(Joins sheet 37)



1 705 000 FEET

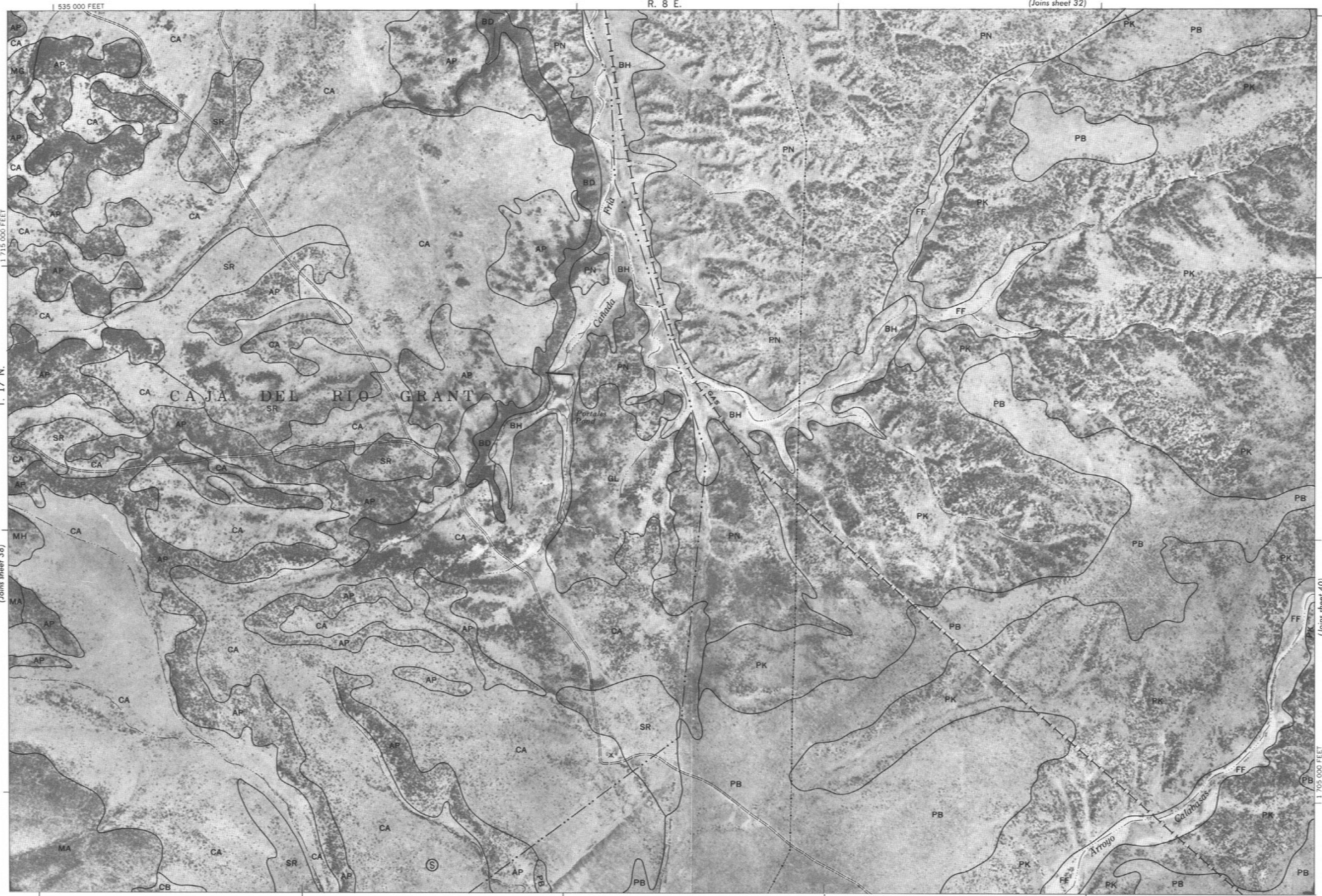
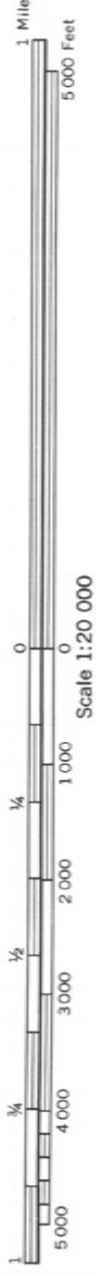
510 000 FEET

(Joins sheet 44)

1 715 000 FEET

(Joins sheet 39)





This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1963-1964 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 45)





R. 8 E.

R. 9 E. (Joins sheet 33)

580 000 FEET

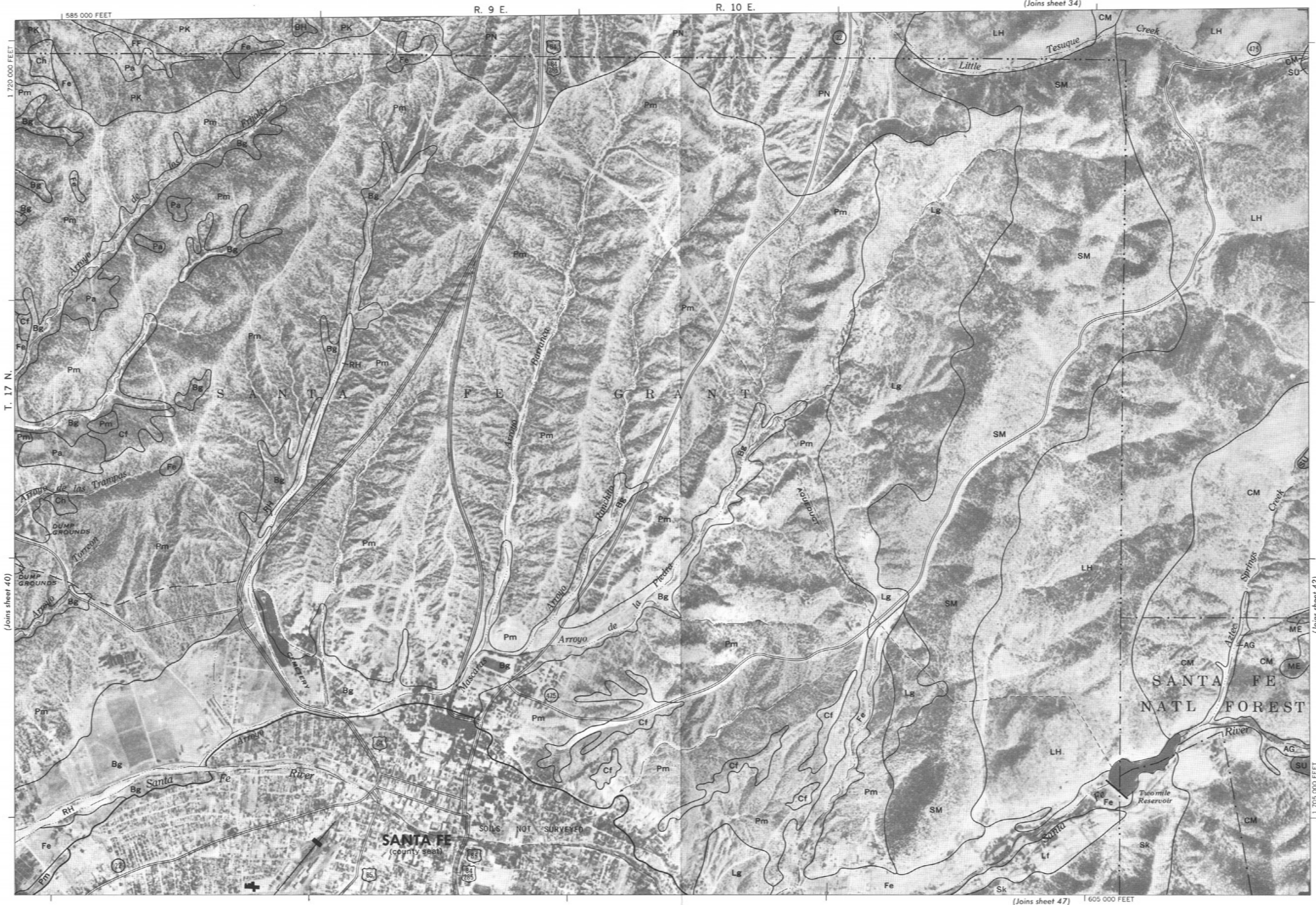


(Joins sheet 39)

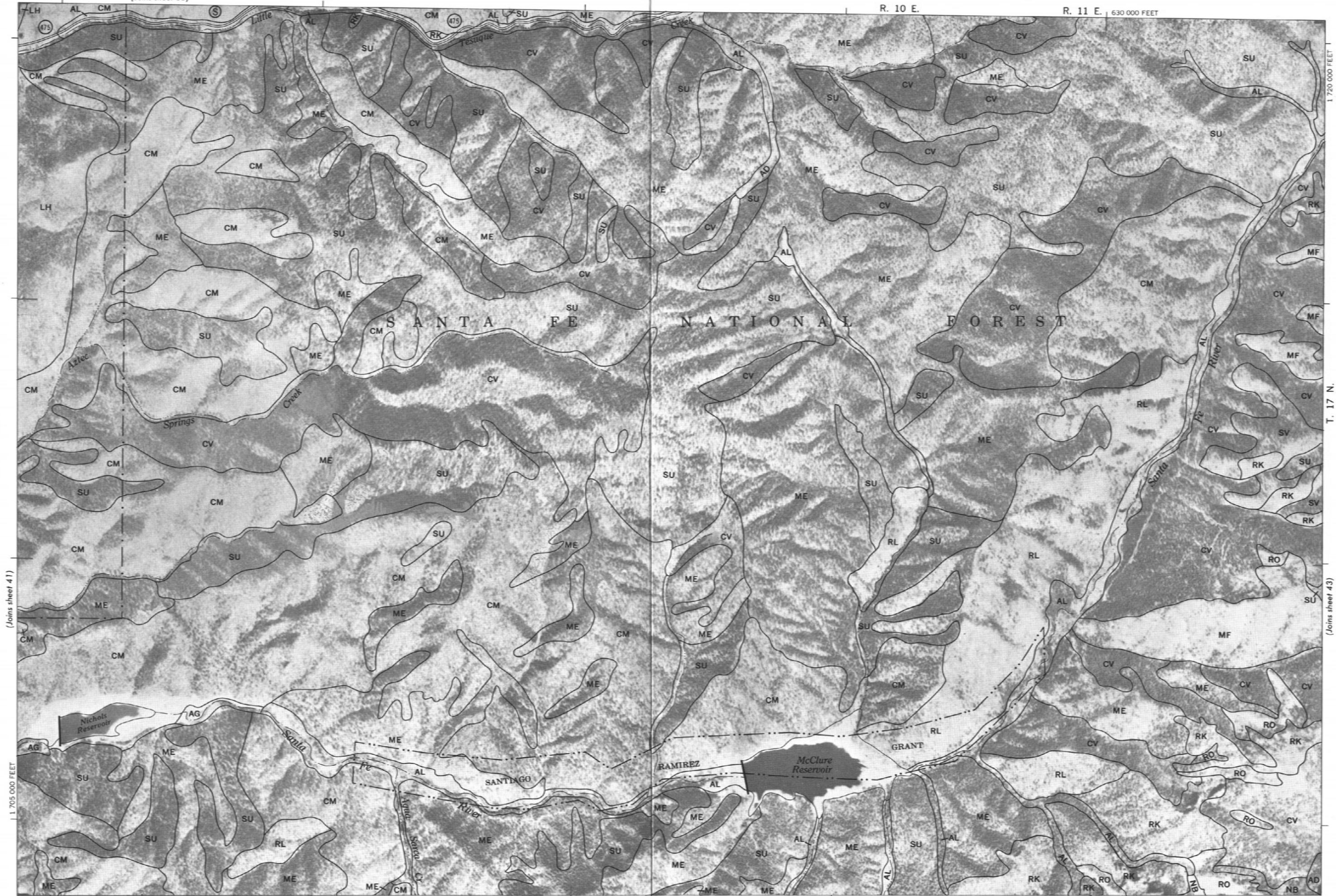
(Joins sheet 41)

(Joins sheet 46)

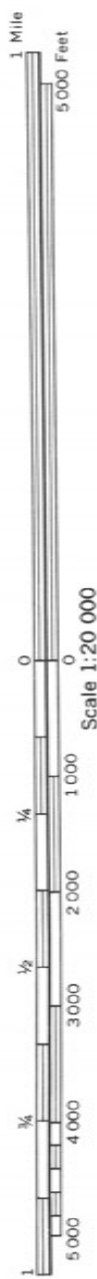
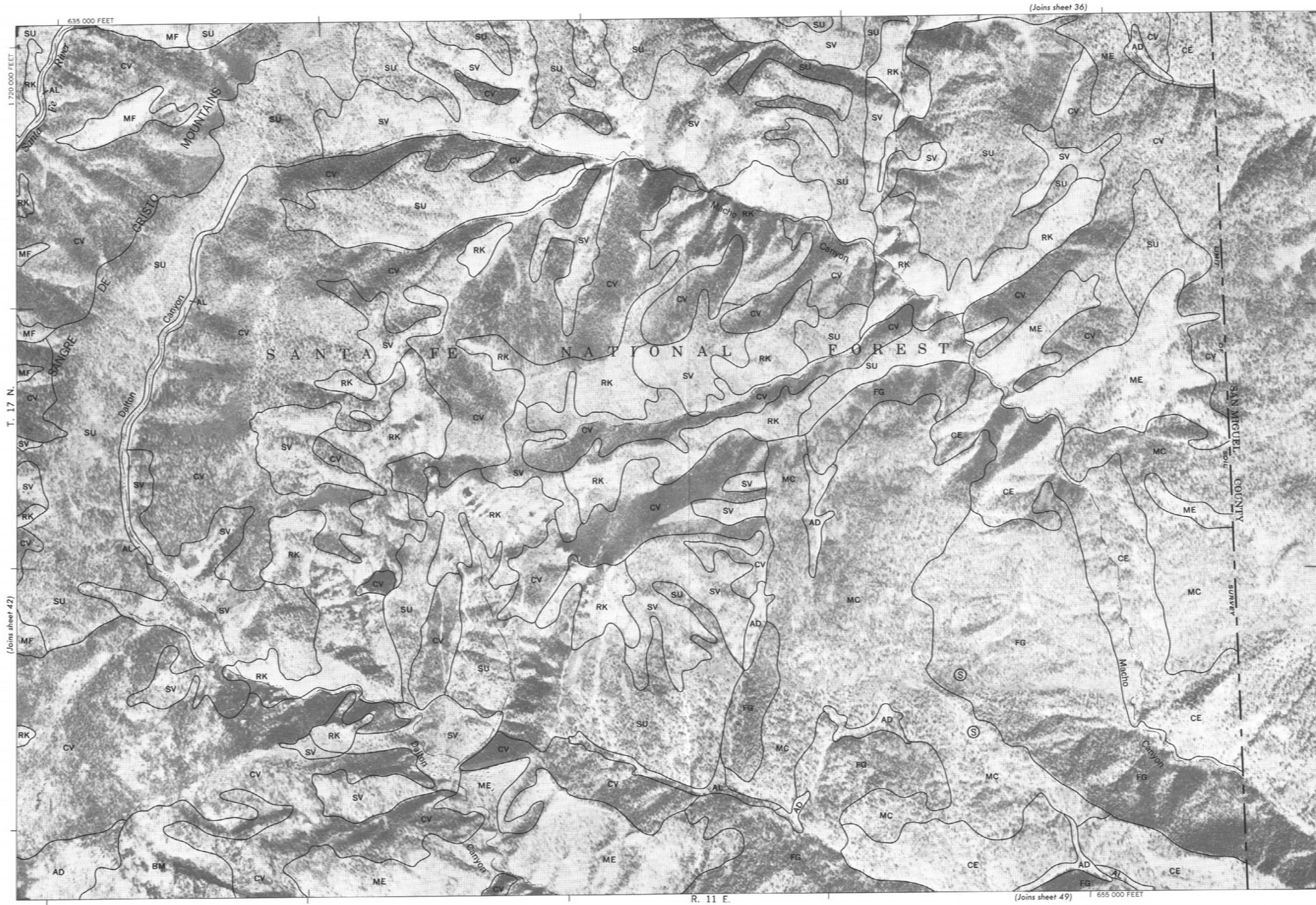




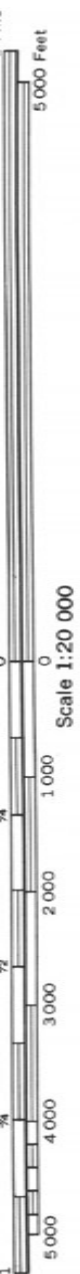












(Joins inset, sheet 50)

1 000 000 FEET

510 000 FEET

(Joins sheet 51)



1 700 000 FEET

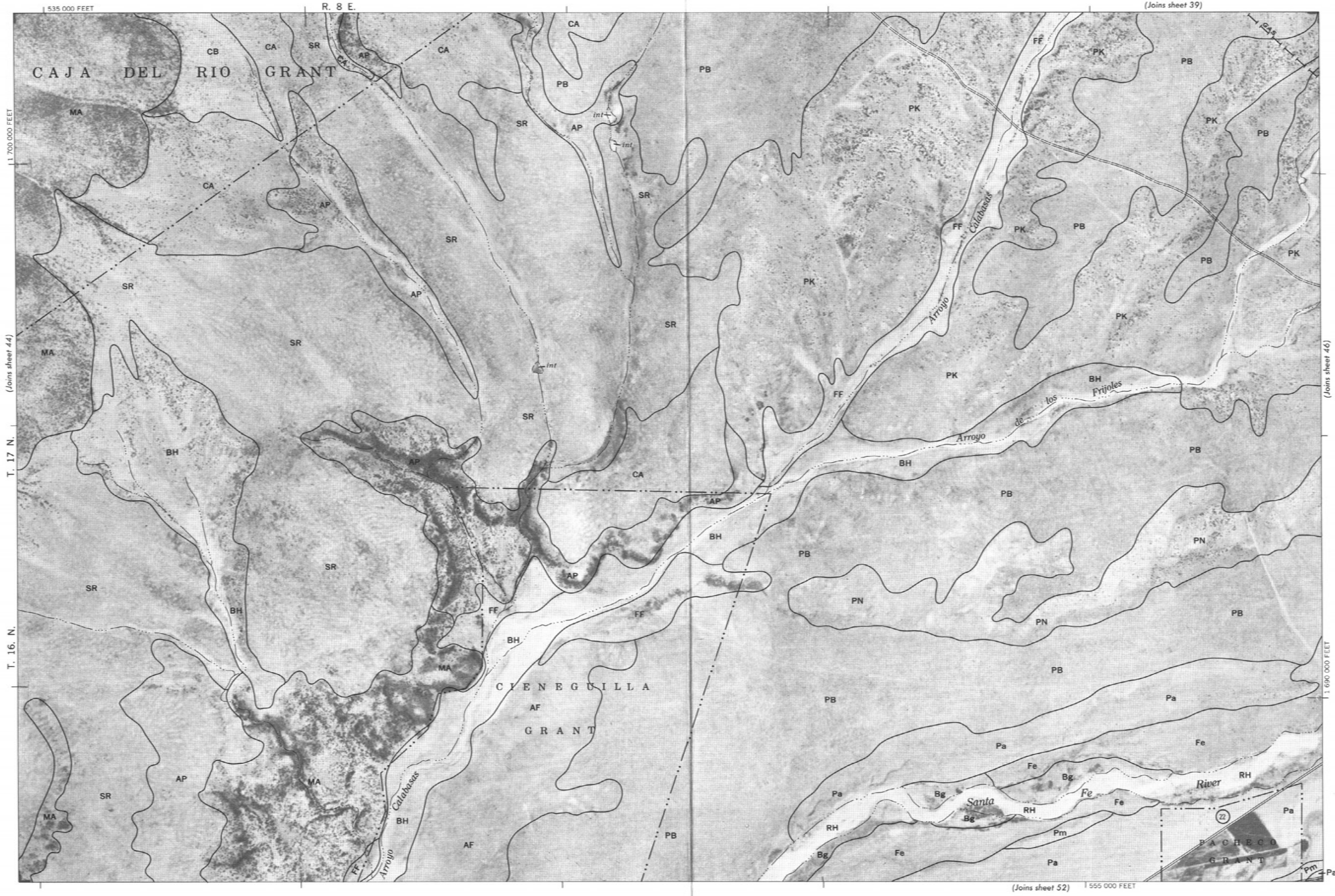
(Joins sheet 45)

T. 17 N.

T. 16 N.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1933-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone. 1927 North American datum.



(Joins sheet 46)

1 Mile

0 1/4 1/2

1,690,000 FEET

Scale 1:20 000





1 Mile  
5000 Feet

(Joins sheet 45)

Scale 1:20 000



1 690 000 FEET



1 700 000 FEET

(Joins sheet 47)

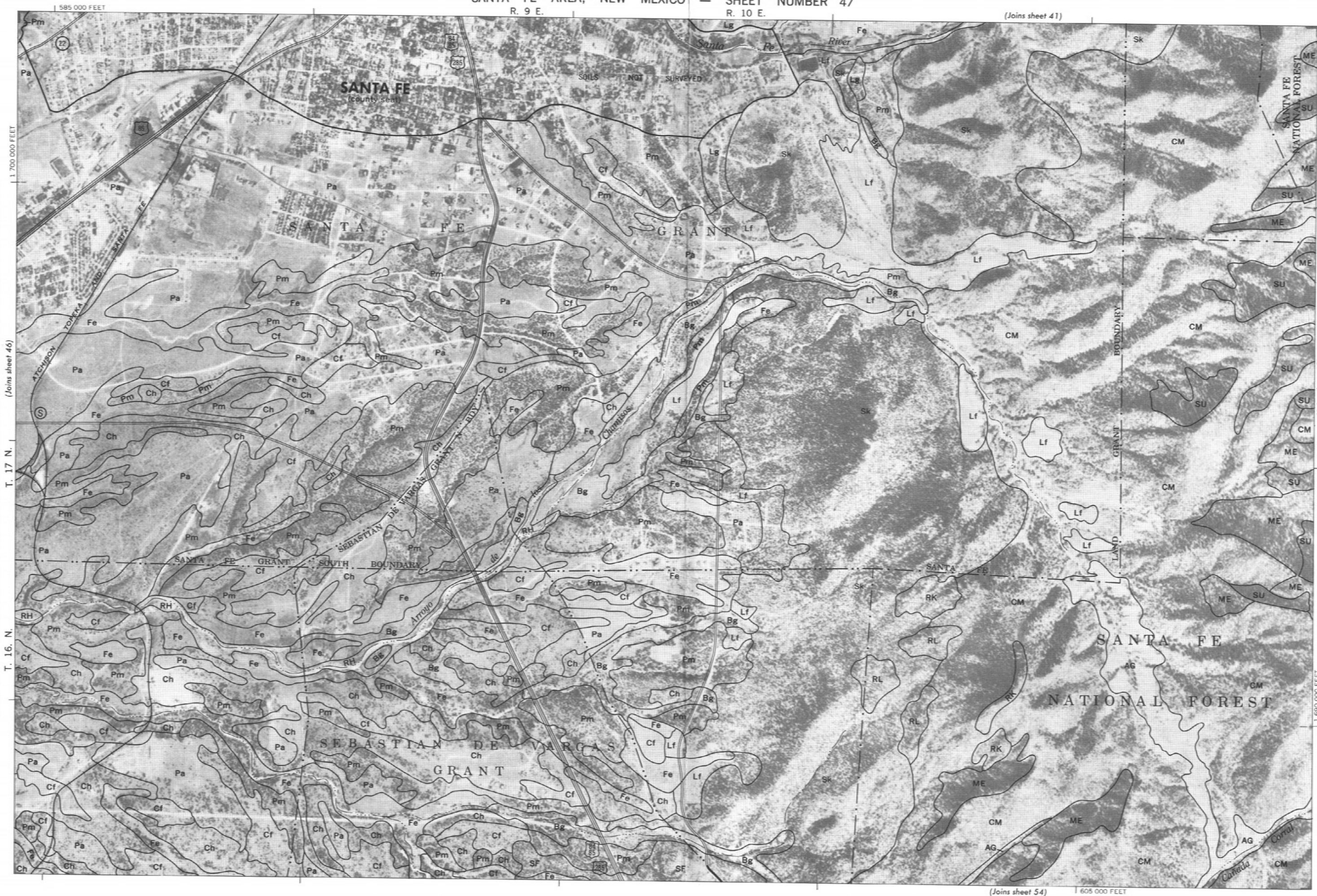
T. 17 N.

T. 16 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.





(Joins sheet 42)

R. 10 E.

R. 11 E.

630 000 FEET



1 Mile  
5 000 Feet

Scale 1:20 000

(Joins sheet 47)

0 1 000 2 000 3 000 4 000 5 000

1 690 000 FEET

0 1 000 2 000 3 000 4 000 5 000

1 690 000 FEET

0 1 000 2 000 3 000 4 000 5 000

1 690 000 FEET

0 1 000 2 000 3 000 4 000 5 000

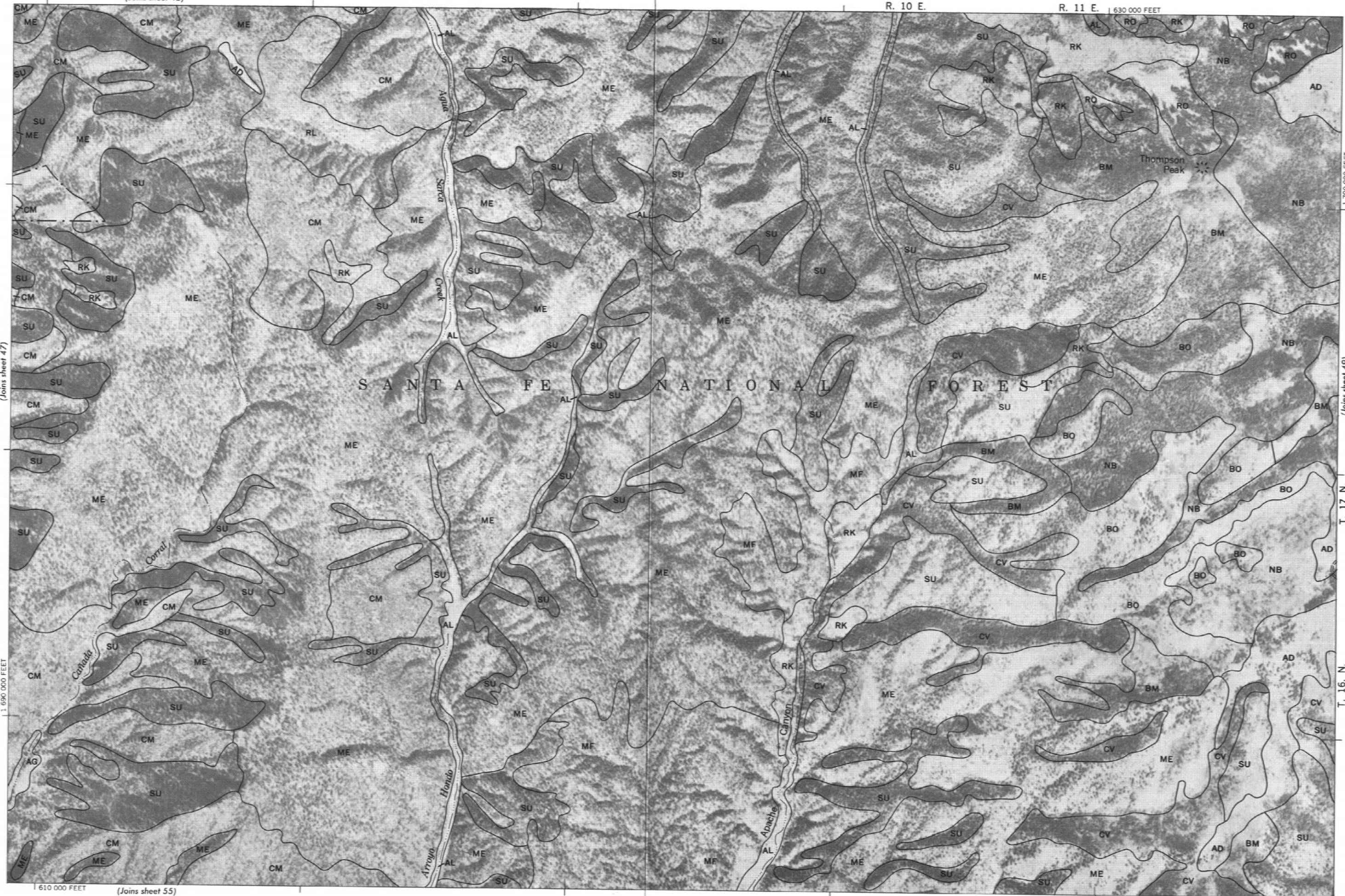
1 690 000 FEET

0 1 000 2 000 3 000 4 000 5 000

1 690 000 FEET

0 1 000 2 000 3 000 4 000 5 000

1 690 000 FEET



1 700 000 FEET

(Joins sheet 49)

T. 17 N.

T. 16 N.

610 000 FEET

(Joins sheet 55)

610 000 FEET

(Joins sheet 55)

610 000 FEET

(Joins sheet 55)

610 000 FEET

(Joins sheet 55)

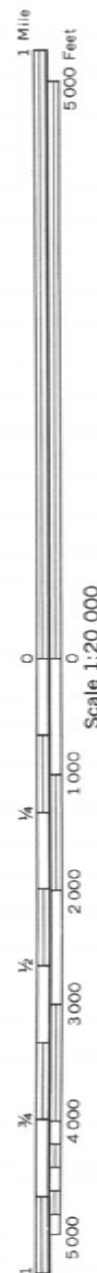
610 000 FEET

(Joins sheet 55)

610 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





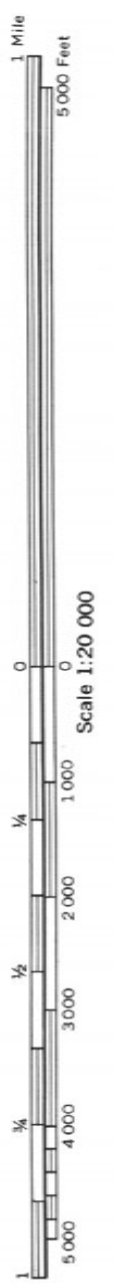
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953, 1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



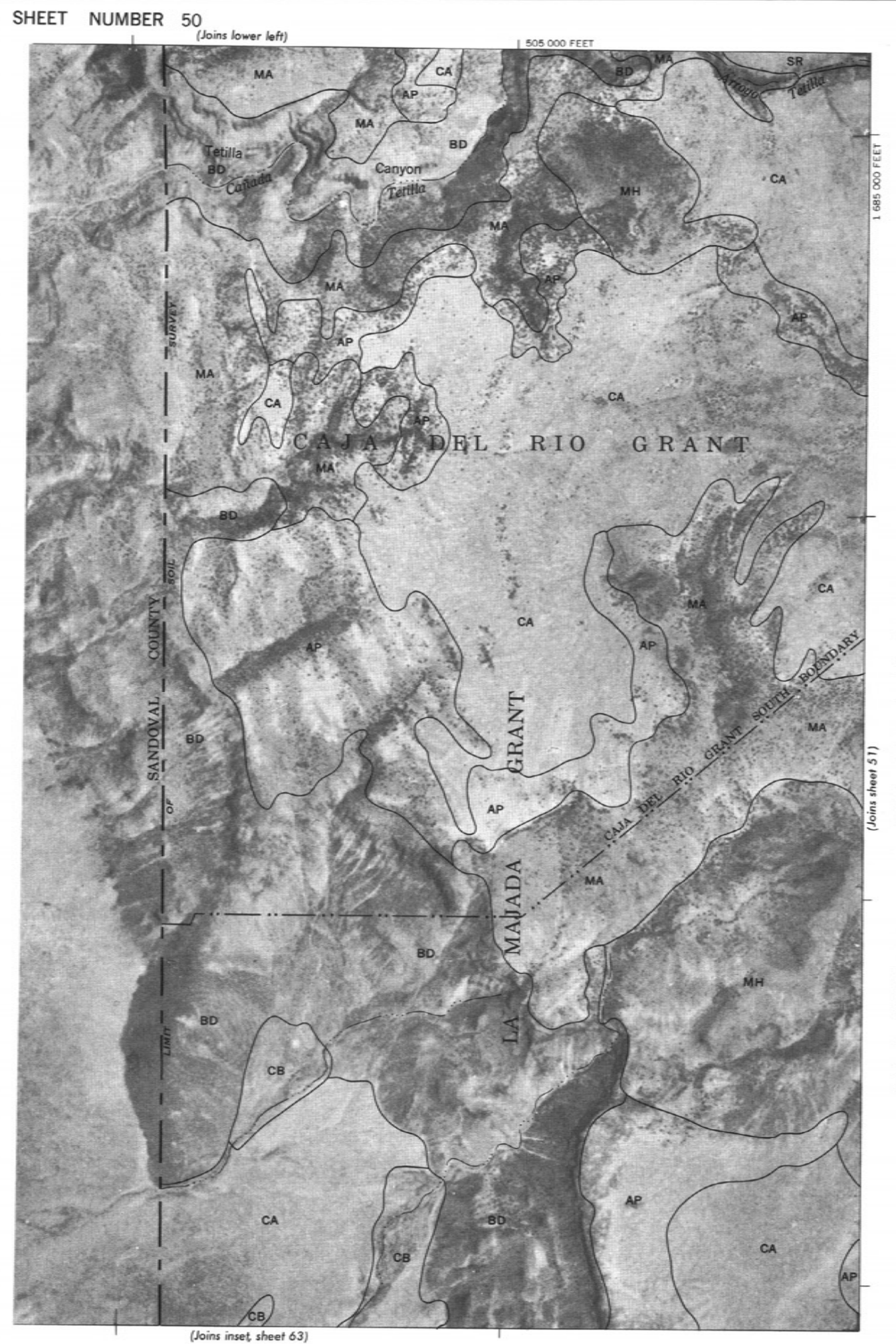
(Joins sheet 48)

(Joins sheet 56)





1 670 000 FEET  
1 485 000 FEET

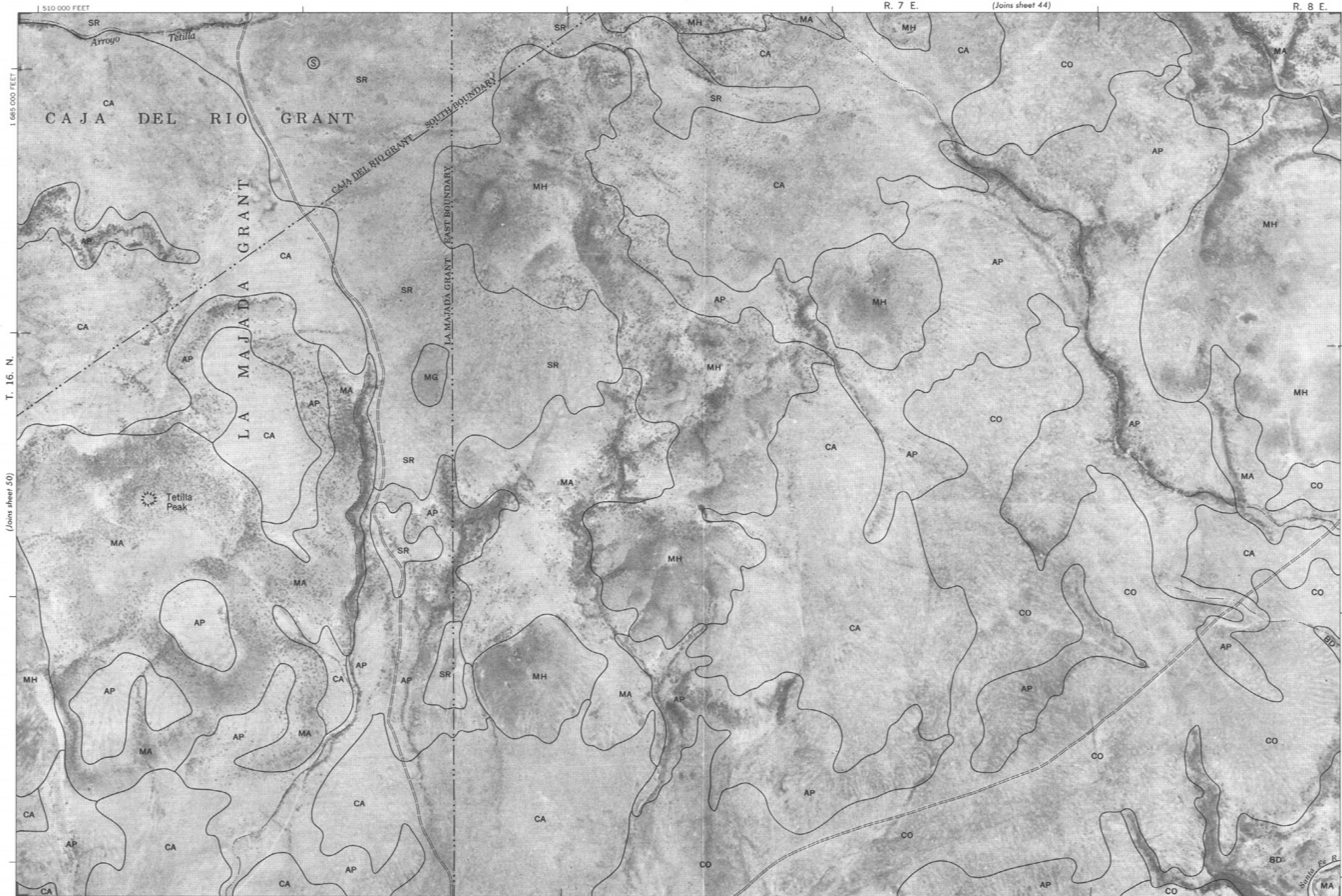


Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





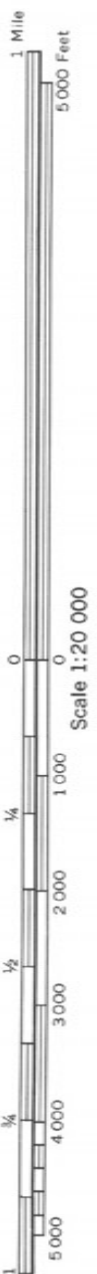
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



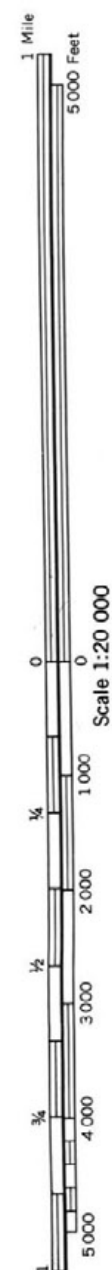
(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 56)







Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



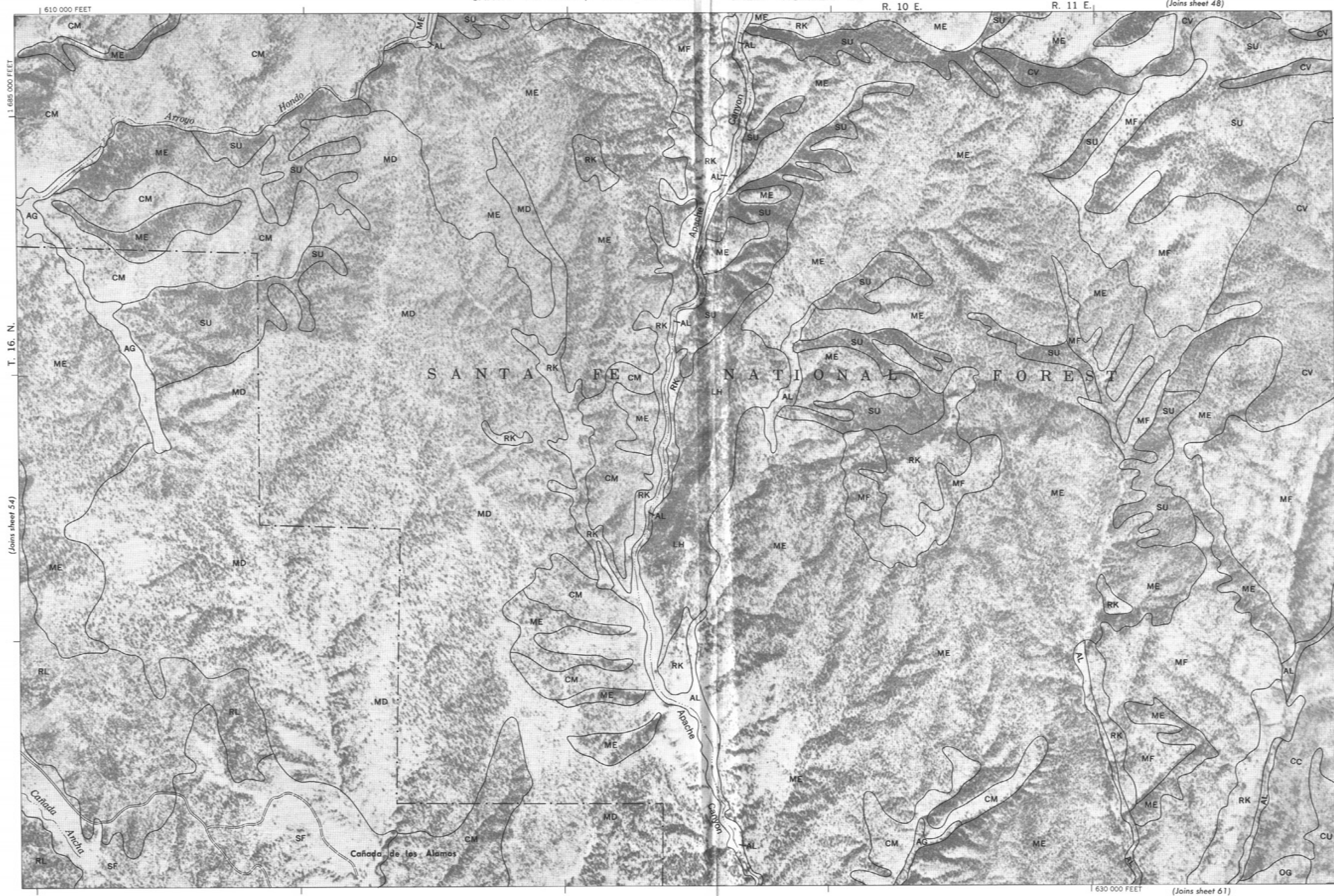








This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 61)





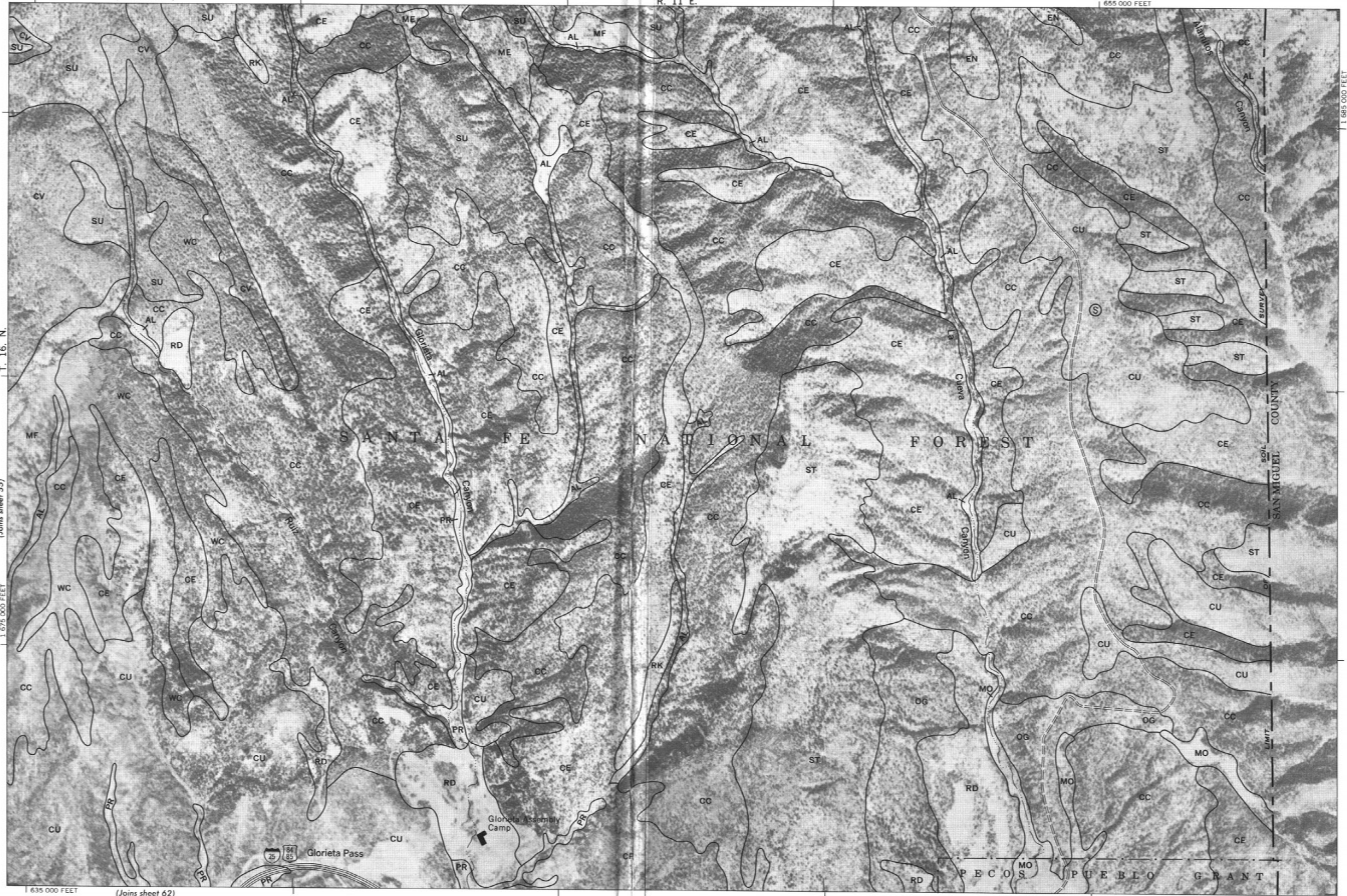
T. 16. N.

(Joins sheet 55)

1 675 000 FEET

635 000 FEET

(Joins sheet 62)



1 685 000 FEET

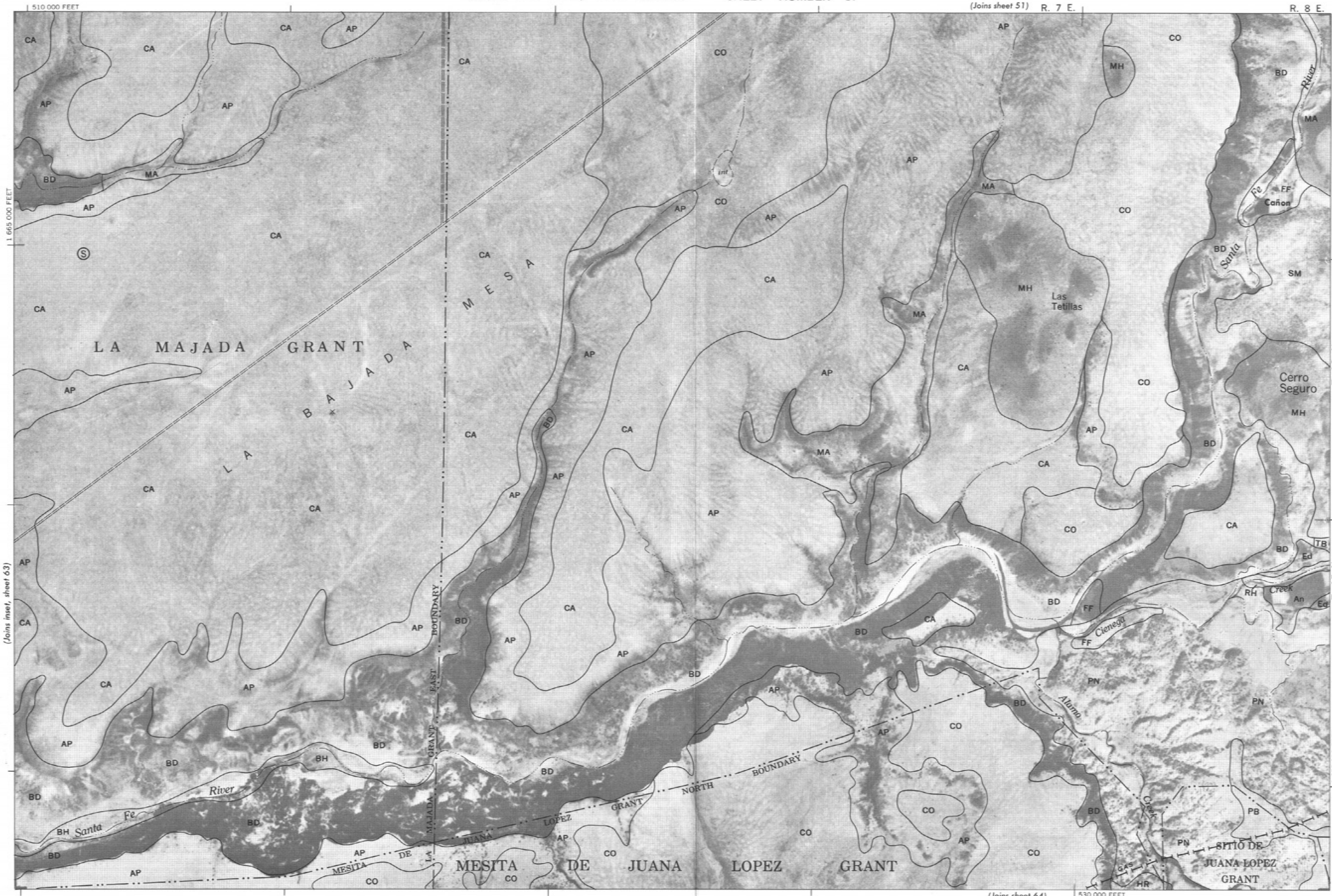
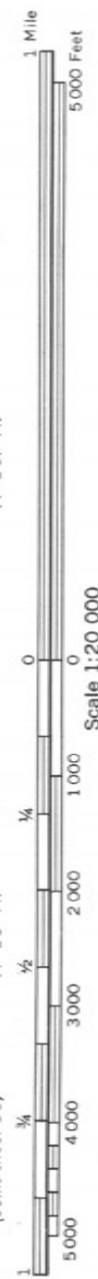
SAN MIGUEL COUNTY

SOIL SURVEY

LIMIT

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

SANTA FE AREA, NEW MEXICO NO. 57

(Joins inset, sheet 63)

(Joins sheet 58)

(Joins sheet 64)

530 000 FEET



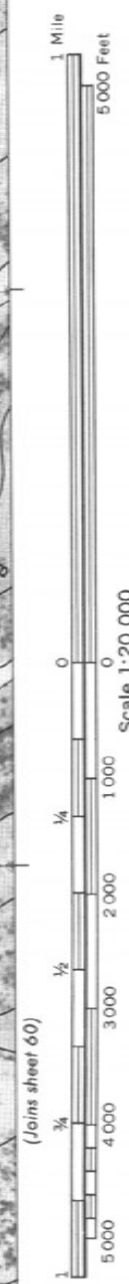


This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.

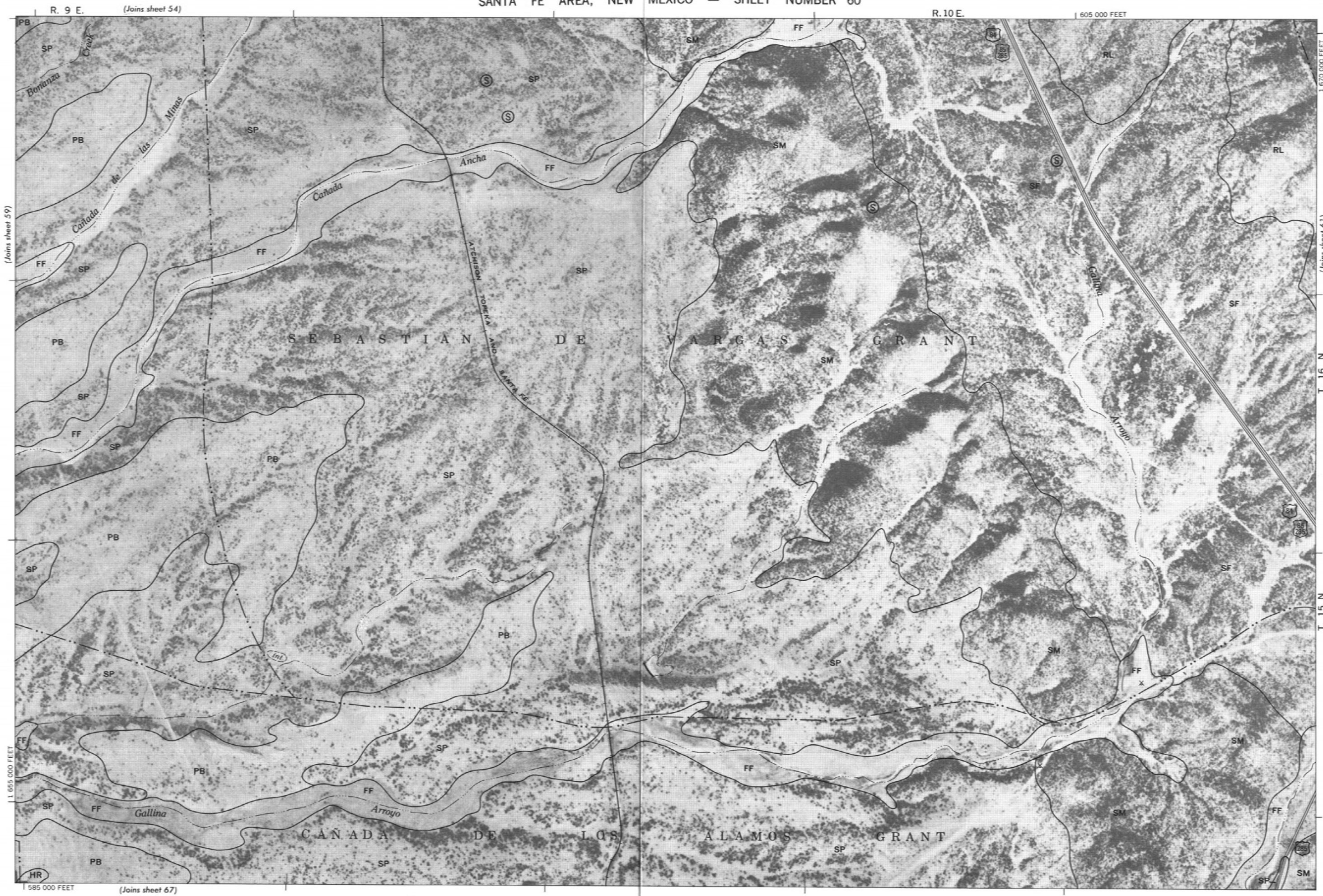
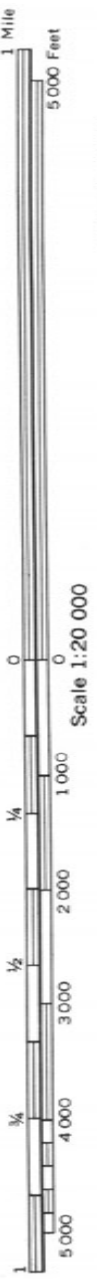
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.







Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.







1 Mile  
5 000 Feet

Scale 1:20 000



(Joins sheet 56)

655 000 FEET

1 670 000 FEET

T. 16. N.

T. 15 N.

SAN MIGUEL COUNTY



1 655 000 FEET

635 000 FEET

(Joins sheet 69)

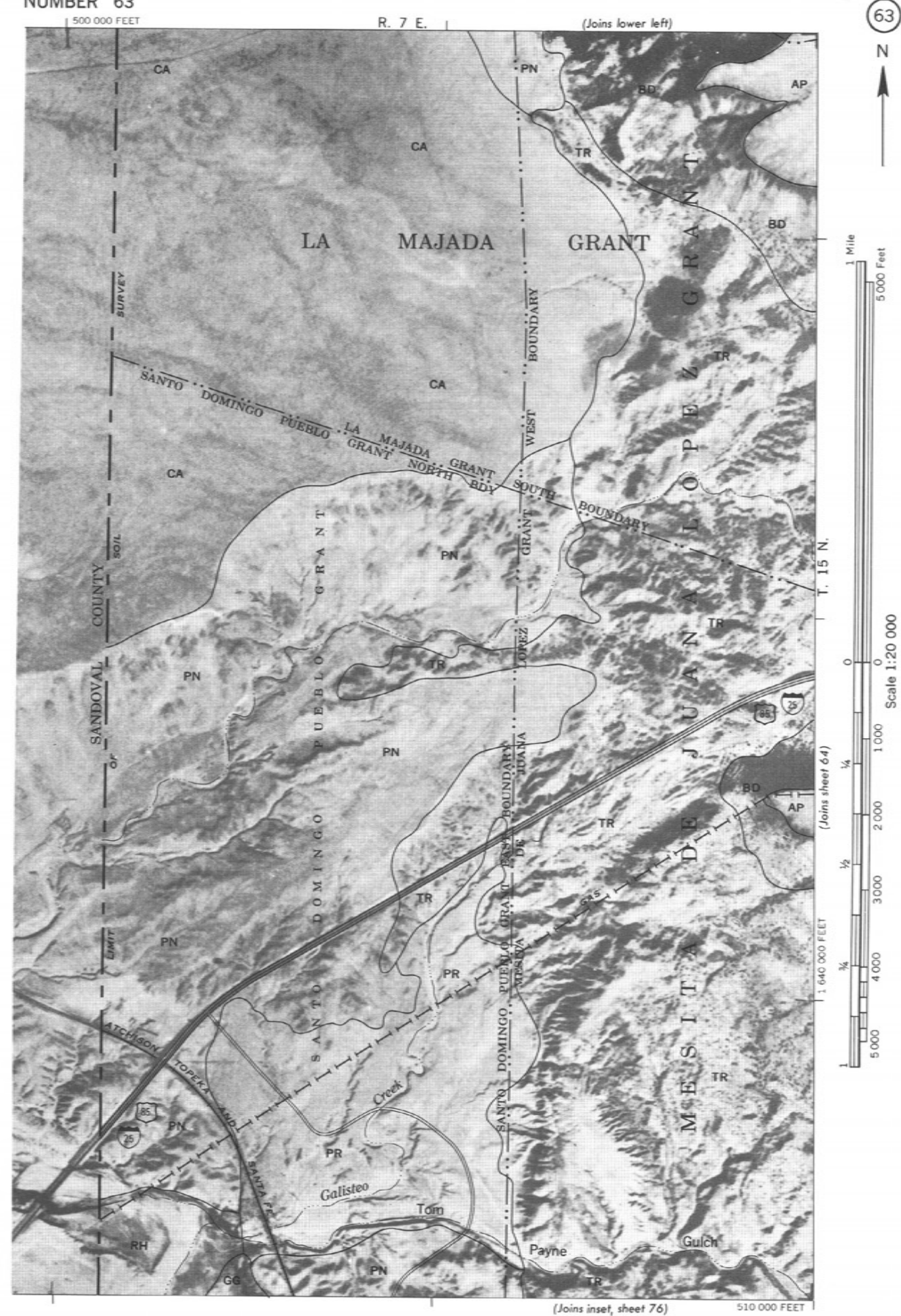
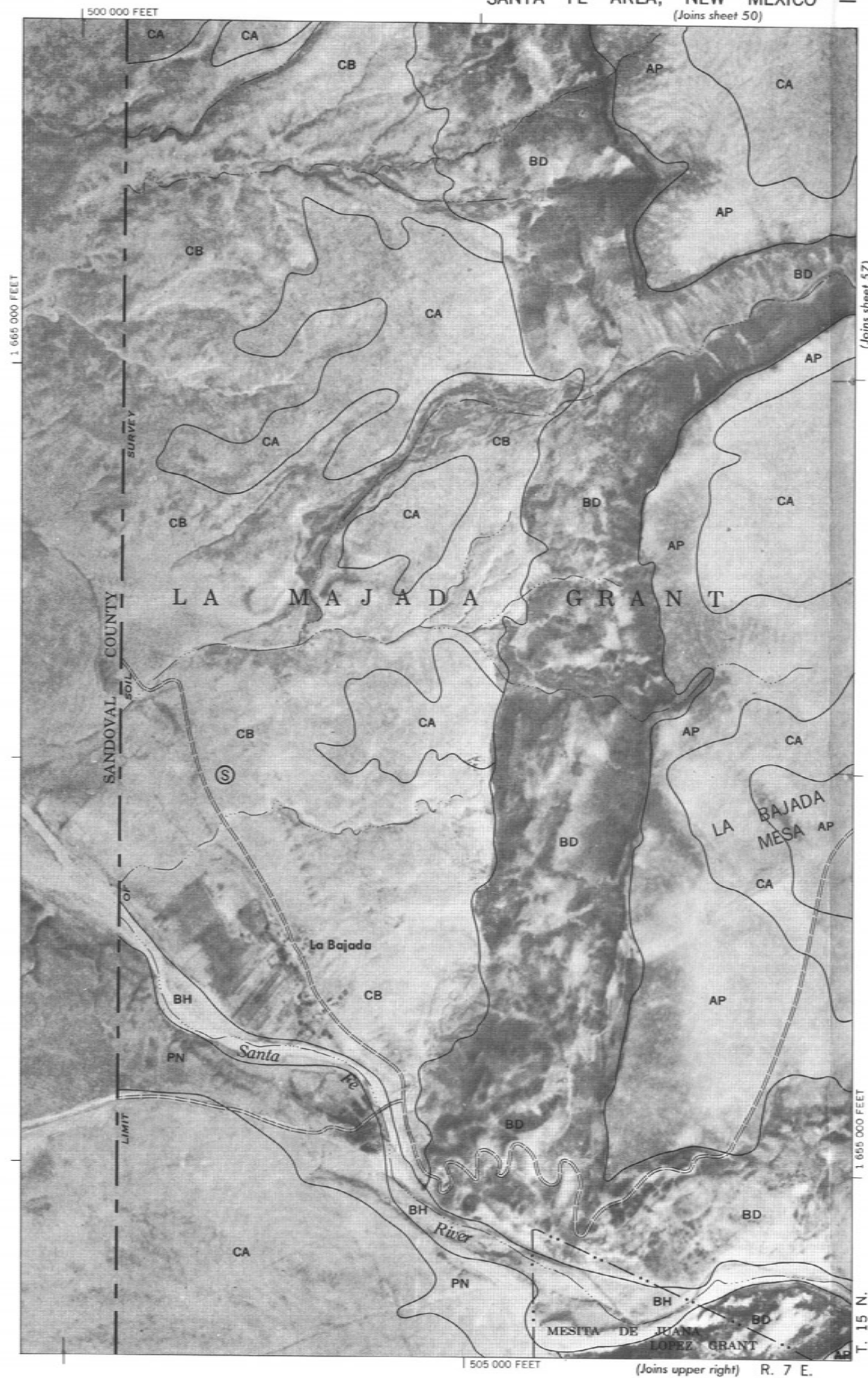
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

SANTA FE AREA, NEW MEXICO, NO. 62



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 50)





Joins sheet 65)

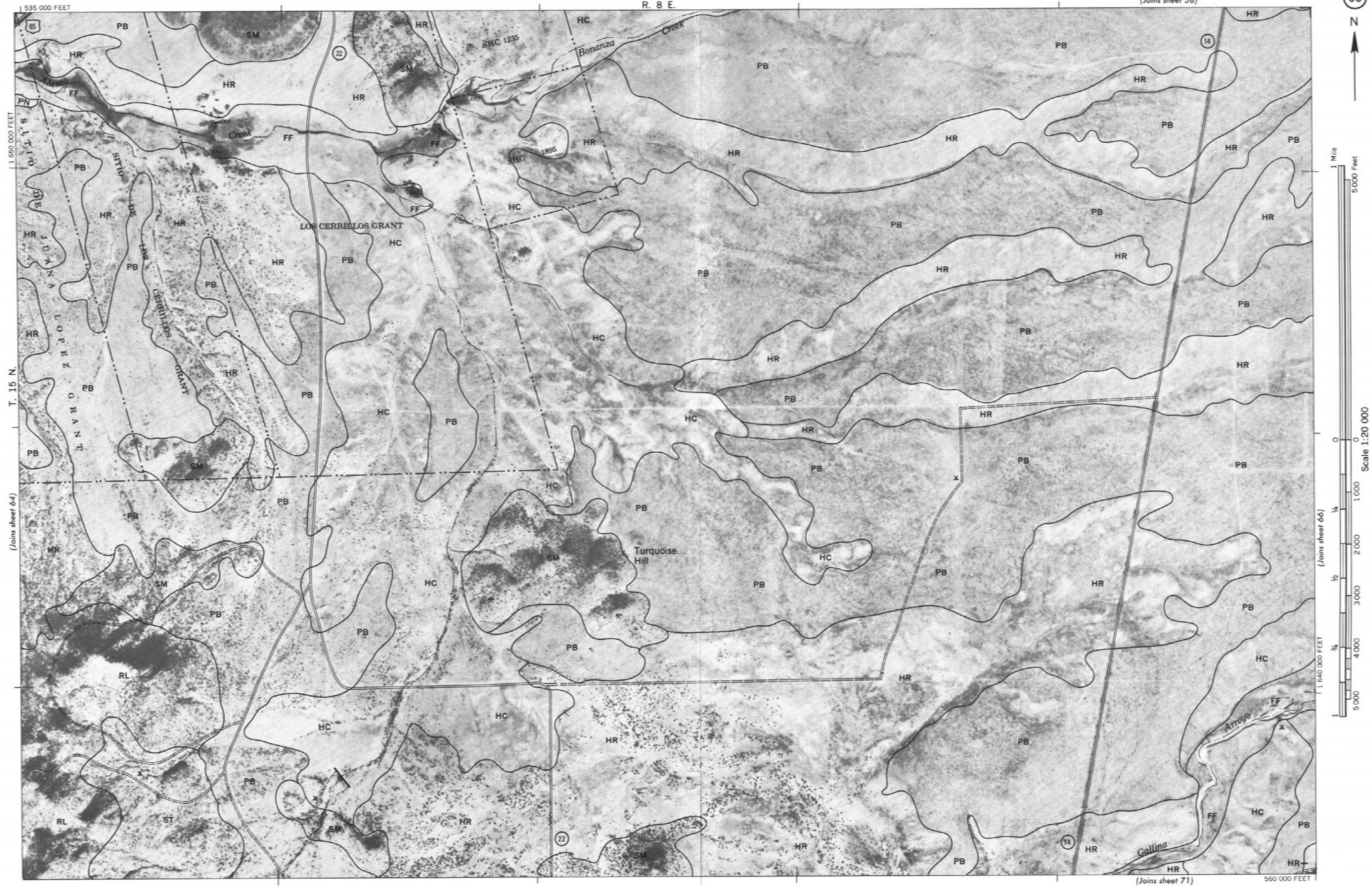
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system; central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service,

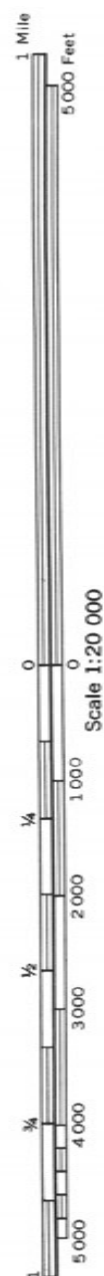
SANTA FE AREA NEW MEXICO NO. 64



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953, 1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system; central zone, 1927 North American datum.







Scale 1:20 000

(Joins sheet 65)

1 640 000 FEET

560 000 FEET

(Joins sheet 72)

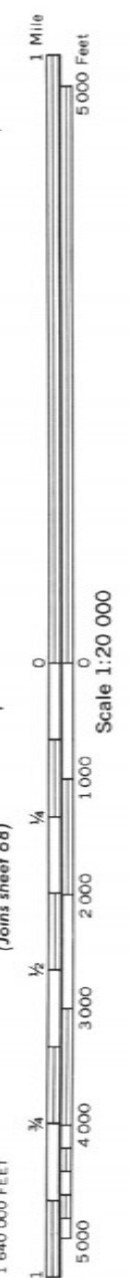
1 650 000 FEET

T. 15 N.

(Joins sheet 67)



(Joins sheet 60)

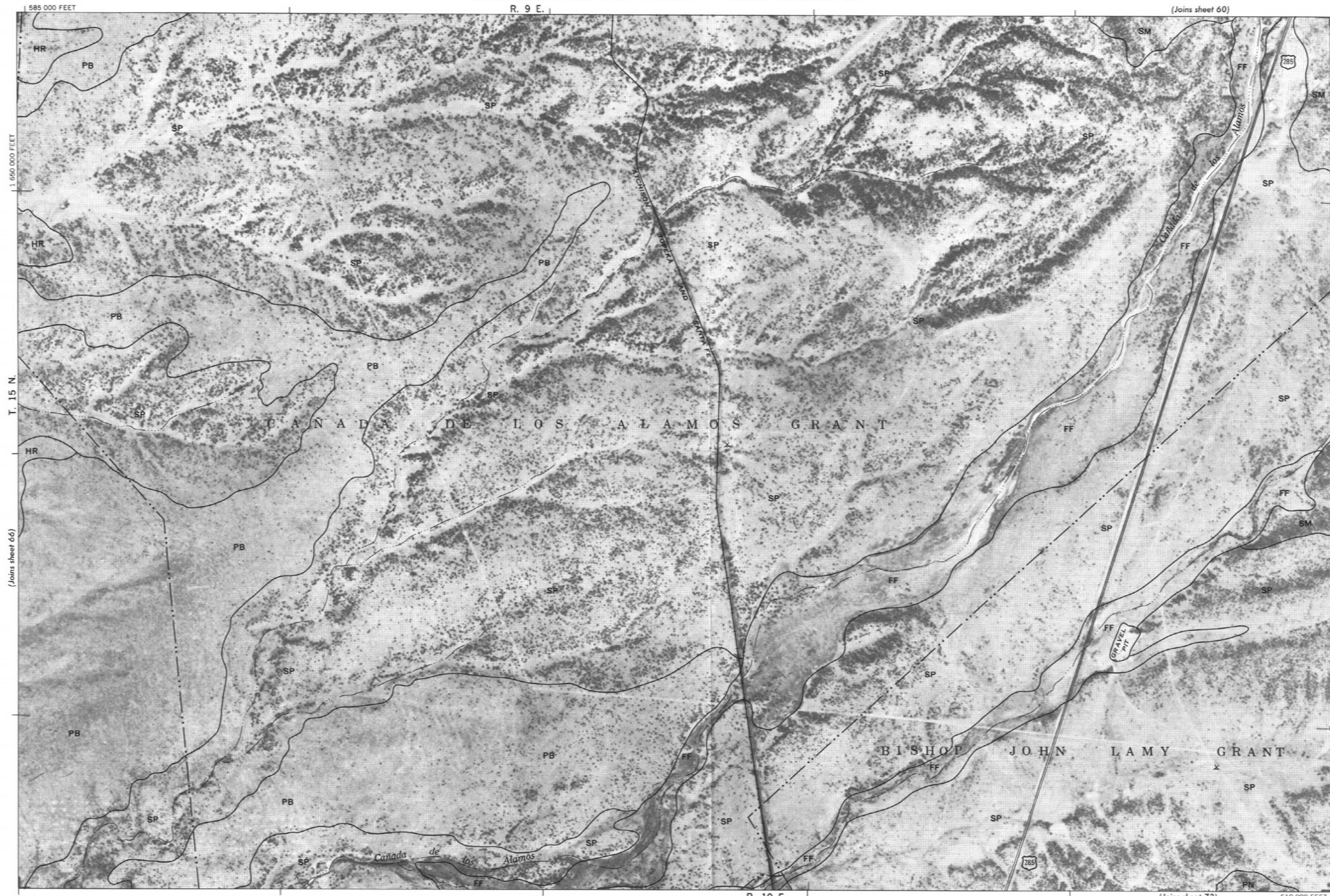


(Joins sheet 68)

610 000 FEET

(Joins sheet 73)

R. 10 E.



T. 15 N.

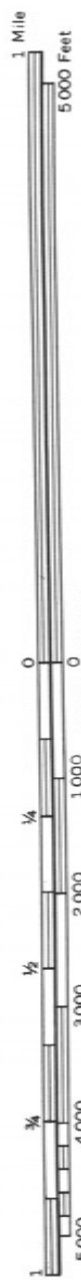
(Joins sheet 66)

1 650 000 FEET

585 000 FEET

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.





(Joins sheet 67)

1 640 000 FEET

(Joins sheet 74)

(Joins sheet 69)

1 650 000 FEET

T. 15 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
 the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
 This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

SANTA FE AREA, NEW MEXICO, NO. 68





T. 15 N.

(Joins sheet 68)

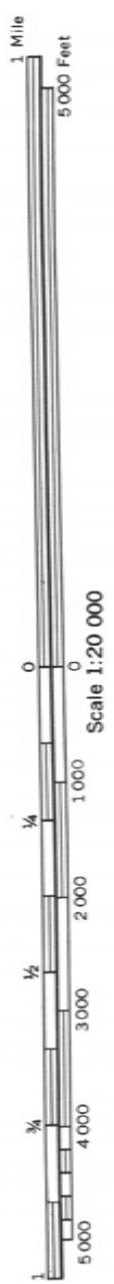
(Joins sheet 75)

655 000 FEET

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



(Joins sheet 64)



(Joins inset, sheet 76)

1 620 000 FEET

(Joins sheet 77)

515 000 FEET

(Joins sheet 71)

T. 15 N.

T. 14 N.

535 000 FEET

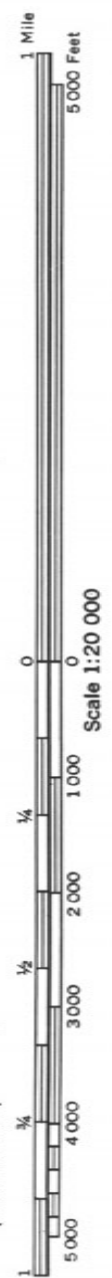
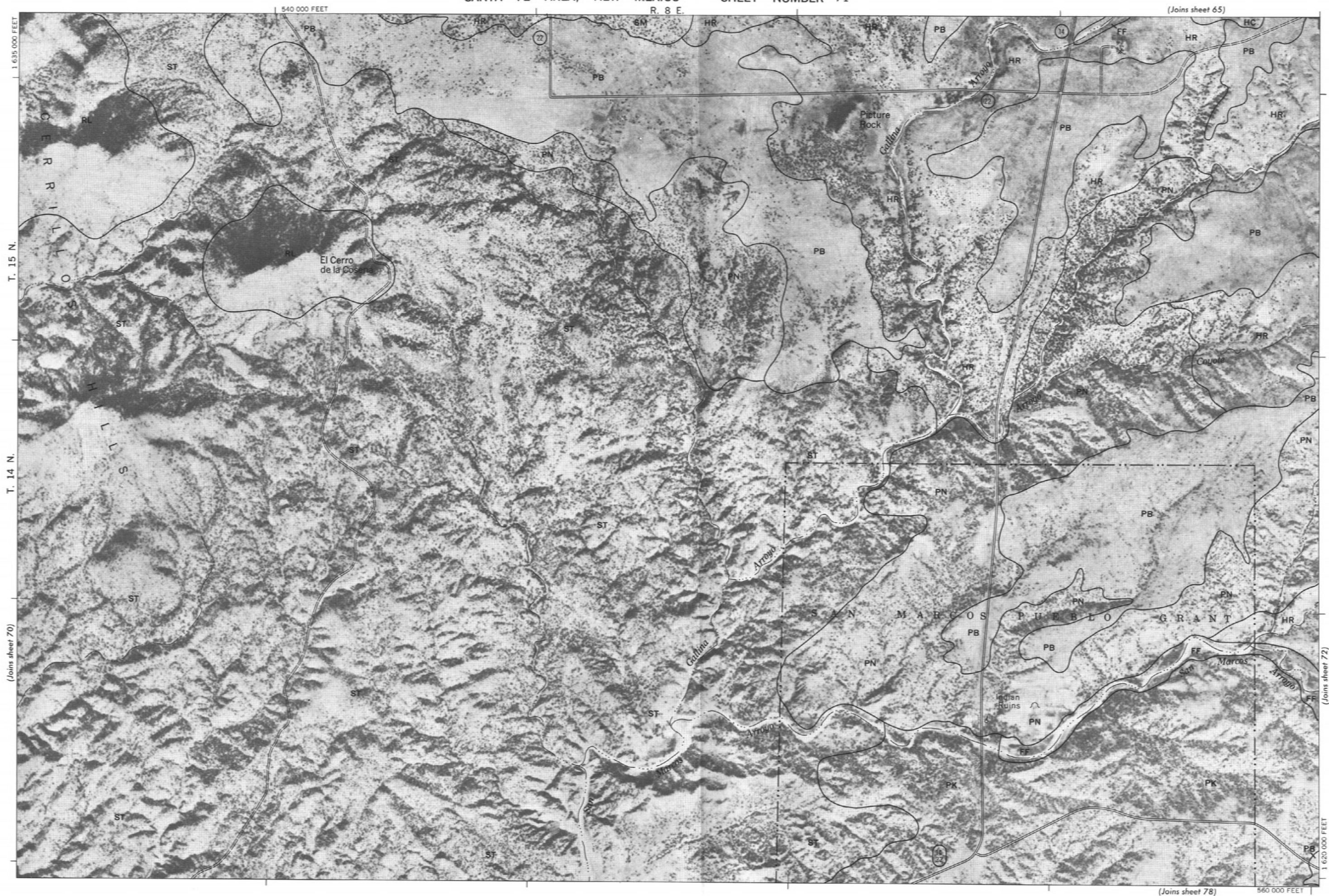
# MESITA DE JUANA LOPEZ GRANT



Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

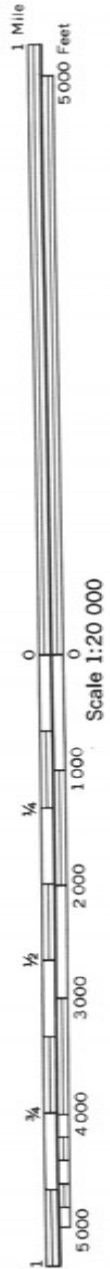


(Joins sheet 70)

(Joins sheet 72)

(Joins sheet 78)







This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1963-1964 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



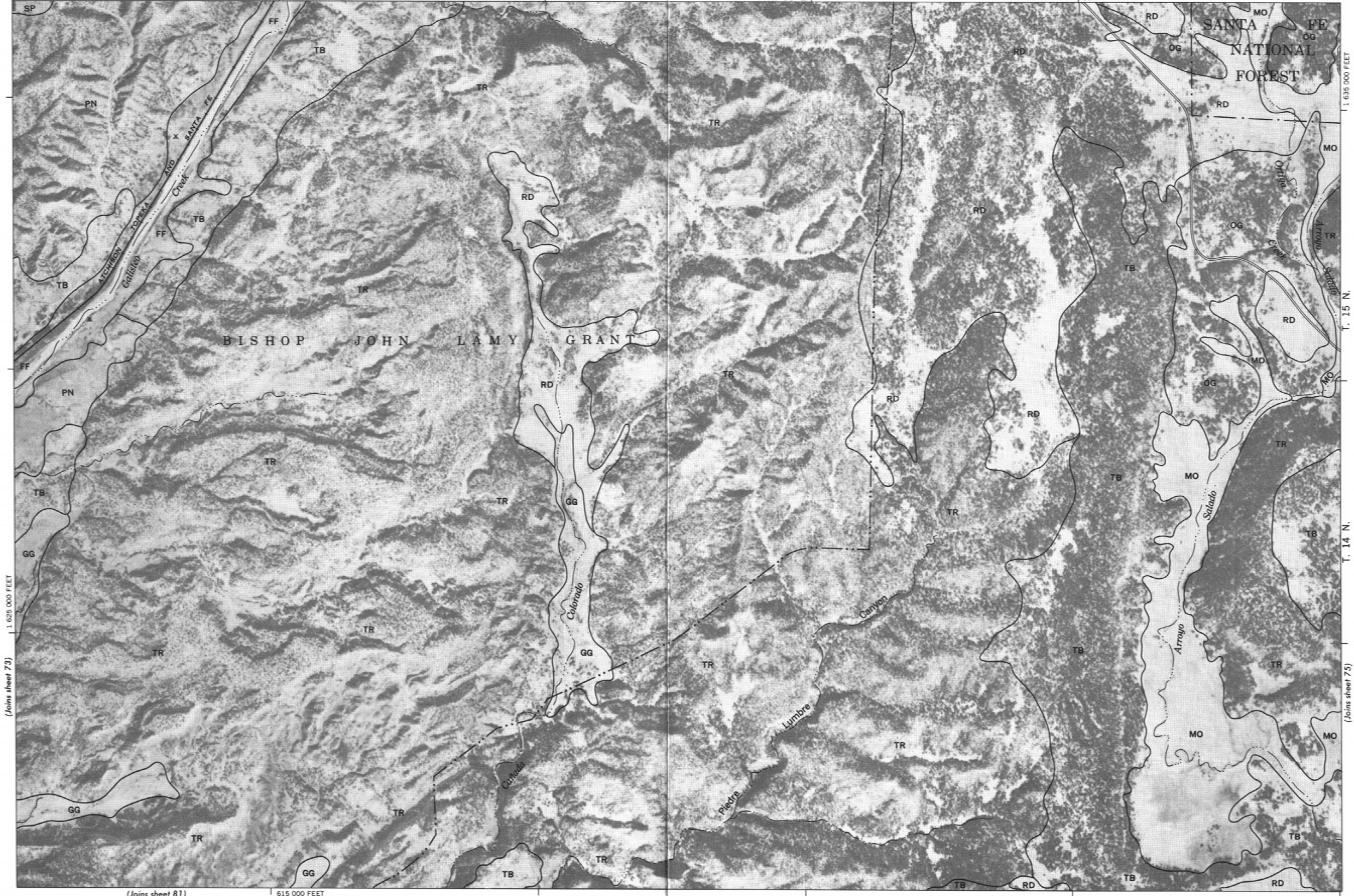
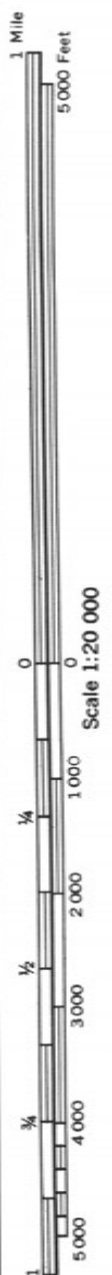


(Joins sheet 68)

R. 10 E.

R. 11 E.

630 000 FEET



1 635 000 FEET

T. 15 N.

T. 14 N.

(Joins sheet 75)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 74)

T. 14 N.

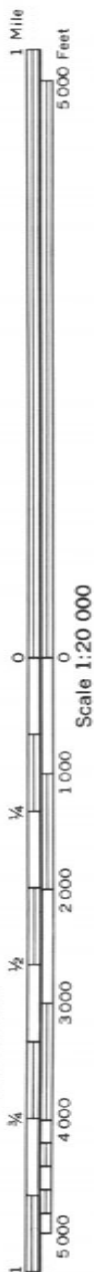
T. 15 N.

635 000 FEET  
1 635 000 FEET



(Joins sheet 82)

660 000 FEET



Scale 1:20 000

5 000 Feet

1 Mile

0

0

1/4

1/2

3/4

1

2 000

3 000

4 000

5 000

0

1 000

2 000

3 000

4 000

5 000

6 000

7 000

8 000

9 000

10 000

11 000

12 000

13 000

14 000

15 000

16 000

17 000

18 000

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261 000

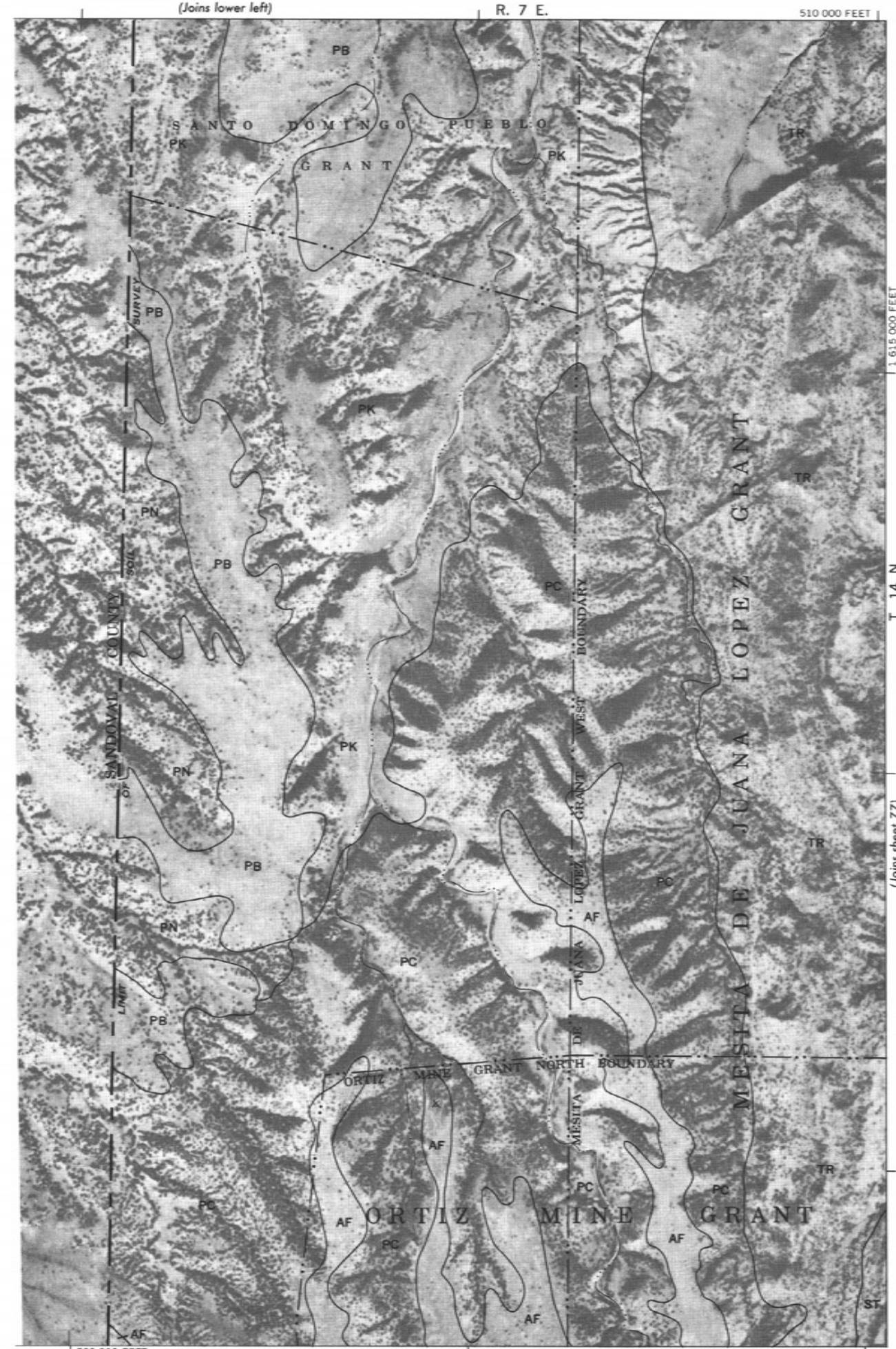
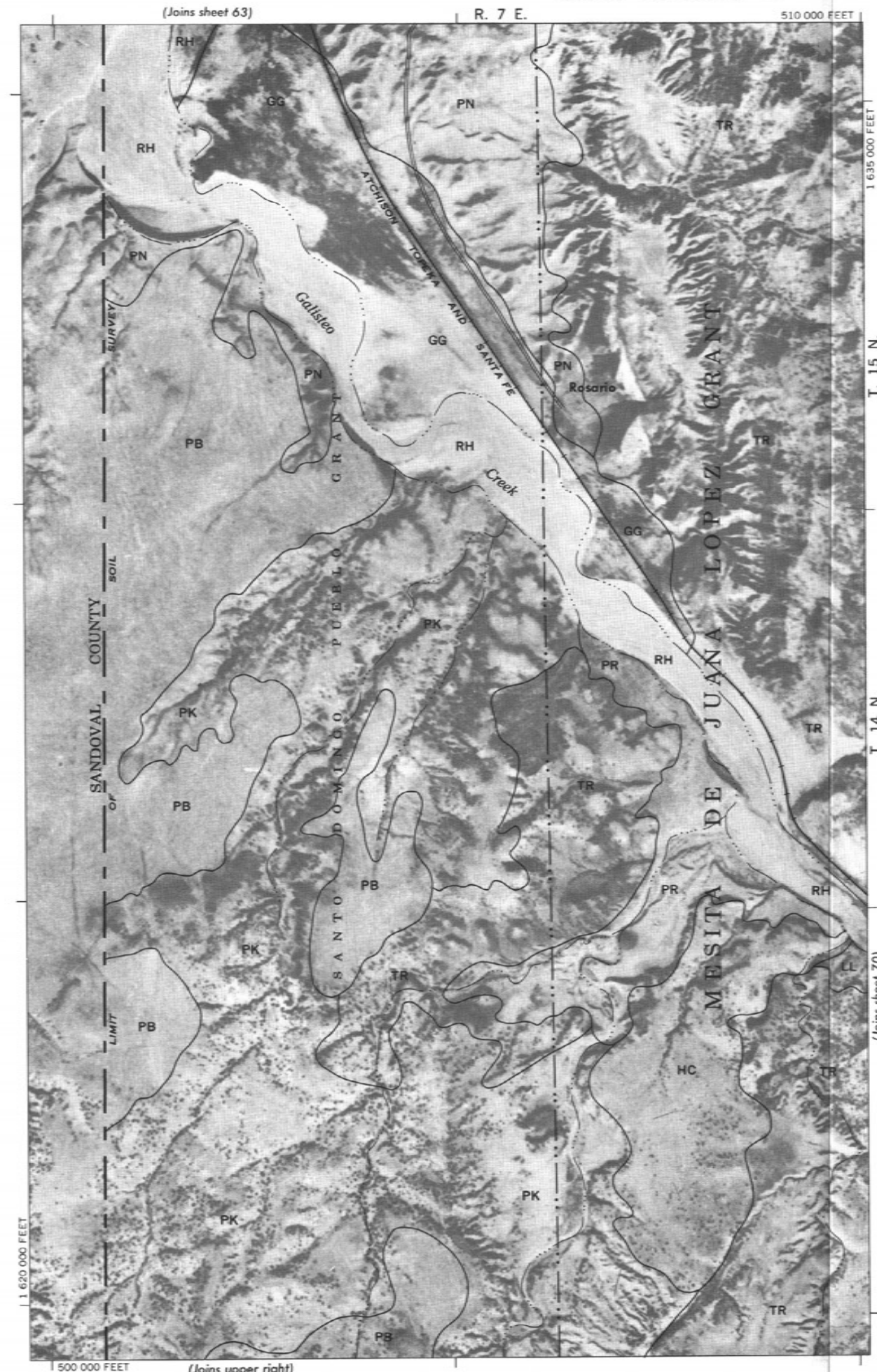
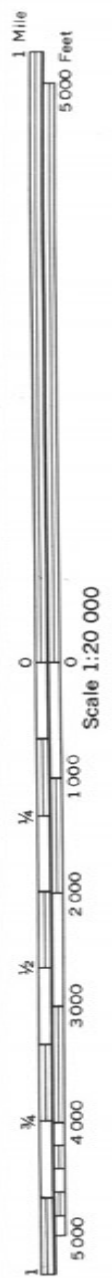
262 000

263 000

264 000

265 000





Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





1 Mile  
5000 Feet

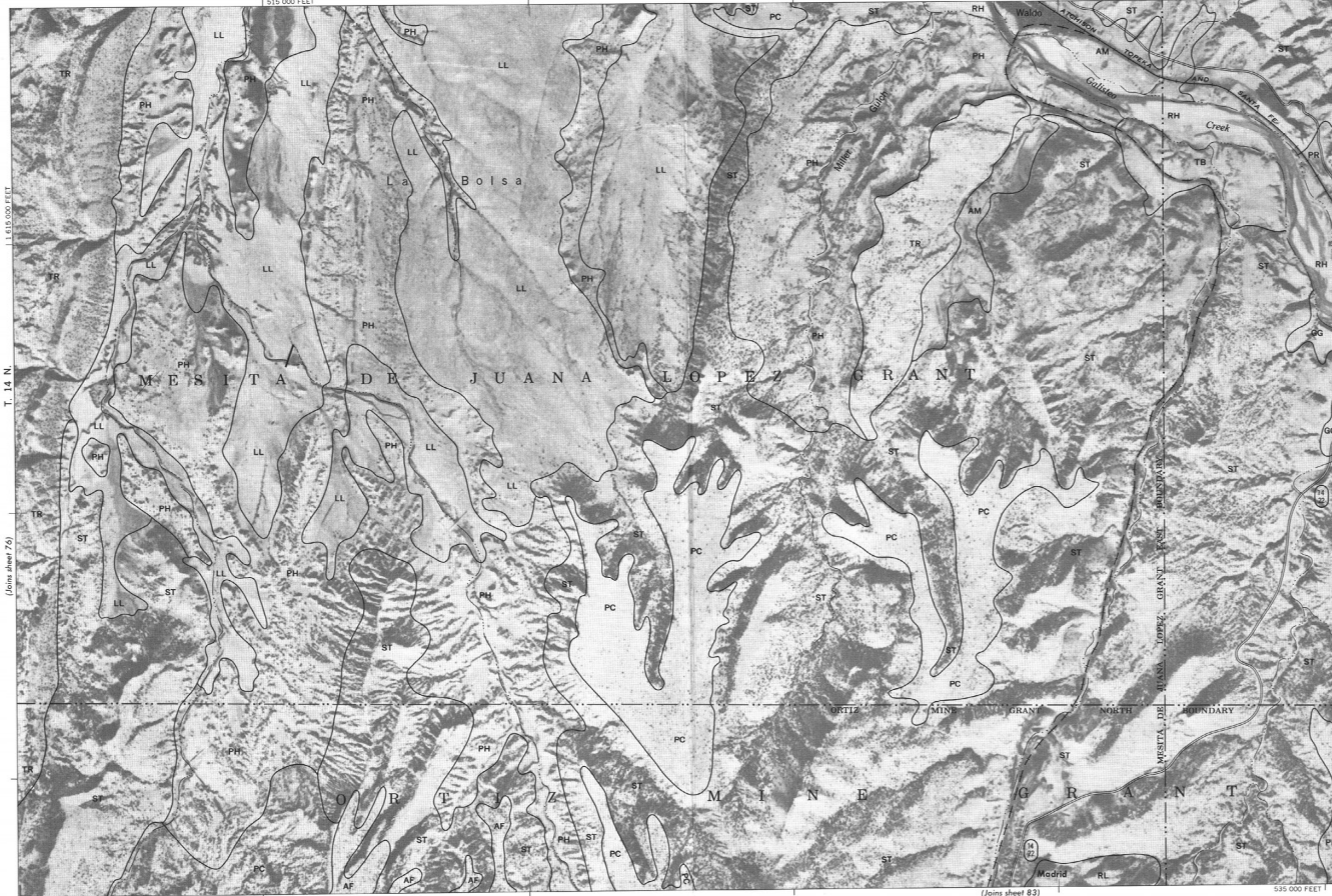
Scale 1:20 000

(Joins sheet 78)

1 605 000 FEET

535 000 FEET

(Joins sheet 83)



1 615 000 FEET

T. 14 N.

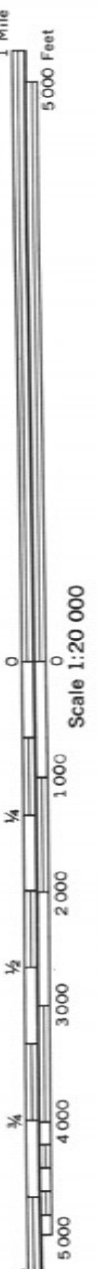
(Joins sheet 76)

515 000 FEET



(Joins sheet 71)

560 000 FEET



Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



R. 8 E.

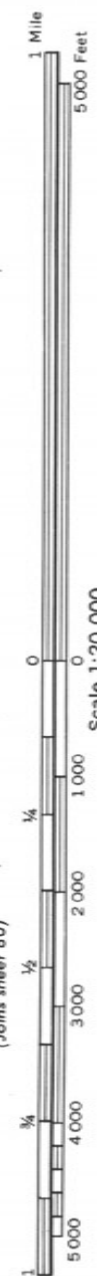
565 000 FEET

R. 9 E.

## SANTA FE AREA, NEW MEXICO — SHEET NUMBER 79

(Joins sheet 72)

79



(Joins sheet 80)

1 605 000 FEET

585 000 FEET

(Joins sheet 85)



(Joins sheet 78)

1 015 000 FEET

T. 14 N.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

SANTA FE AREA, NEW MEXICO NO. 79

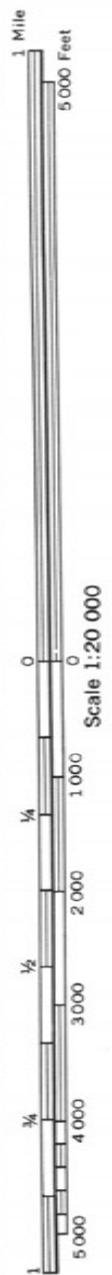


(Joins sheet 73)

R. 9 E.

R. 10 E.

610 000 FEET



(Joins sheet 79)

(Joins sheet 81)

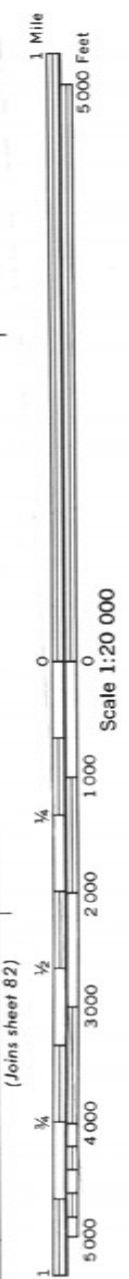
(Joins sheet 86)

590 000 FEET

T. 14 N.

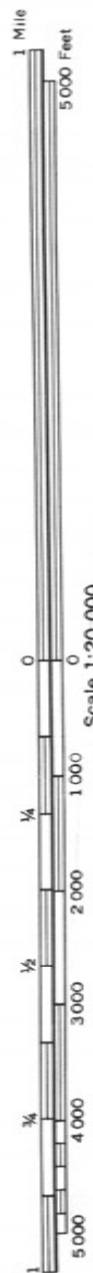
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





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T. 14 N.

(Joins sheet 81)

1 605 000 FEET

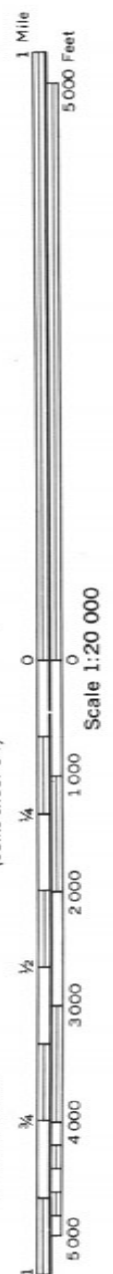
(Joins sheet 88)

640 000 FEET



Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





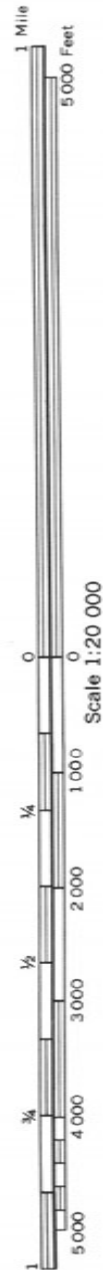
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins inset, sheet 89)

(Joins sheet 84)

(Joins sheet 90)





(Joins sheet 83)



(Joins sheet 91)

540 000 FEET

R. 8 E.

T. 14 N.

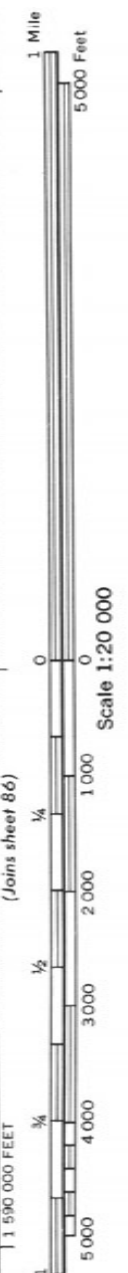
T. 13 N.

(Joins sheet 85)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



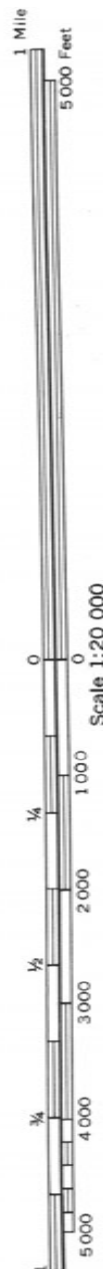
(Joins sheet 84)



(Joins sheet 92)

585 000 FEET |



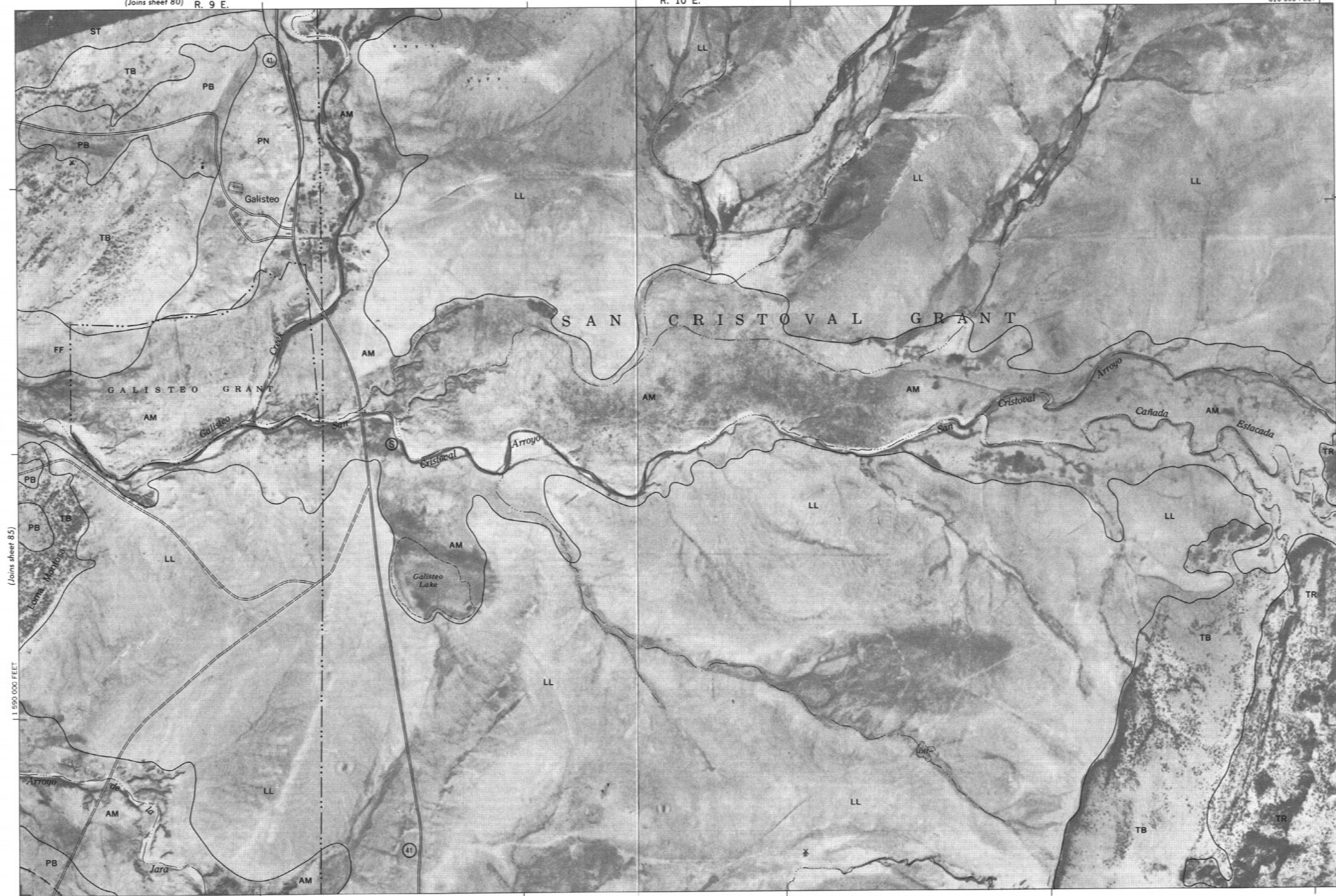


(Joins sheet 85)

1 590 000 FEET

(Joins sheet 93)

590 000 FEET



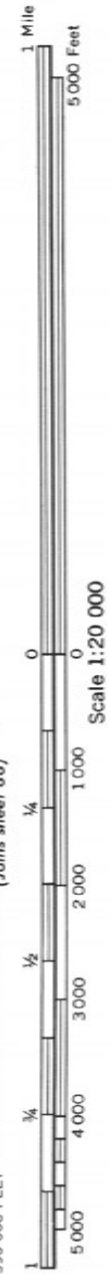
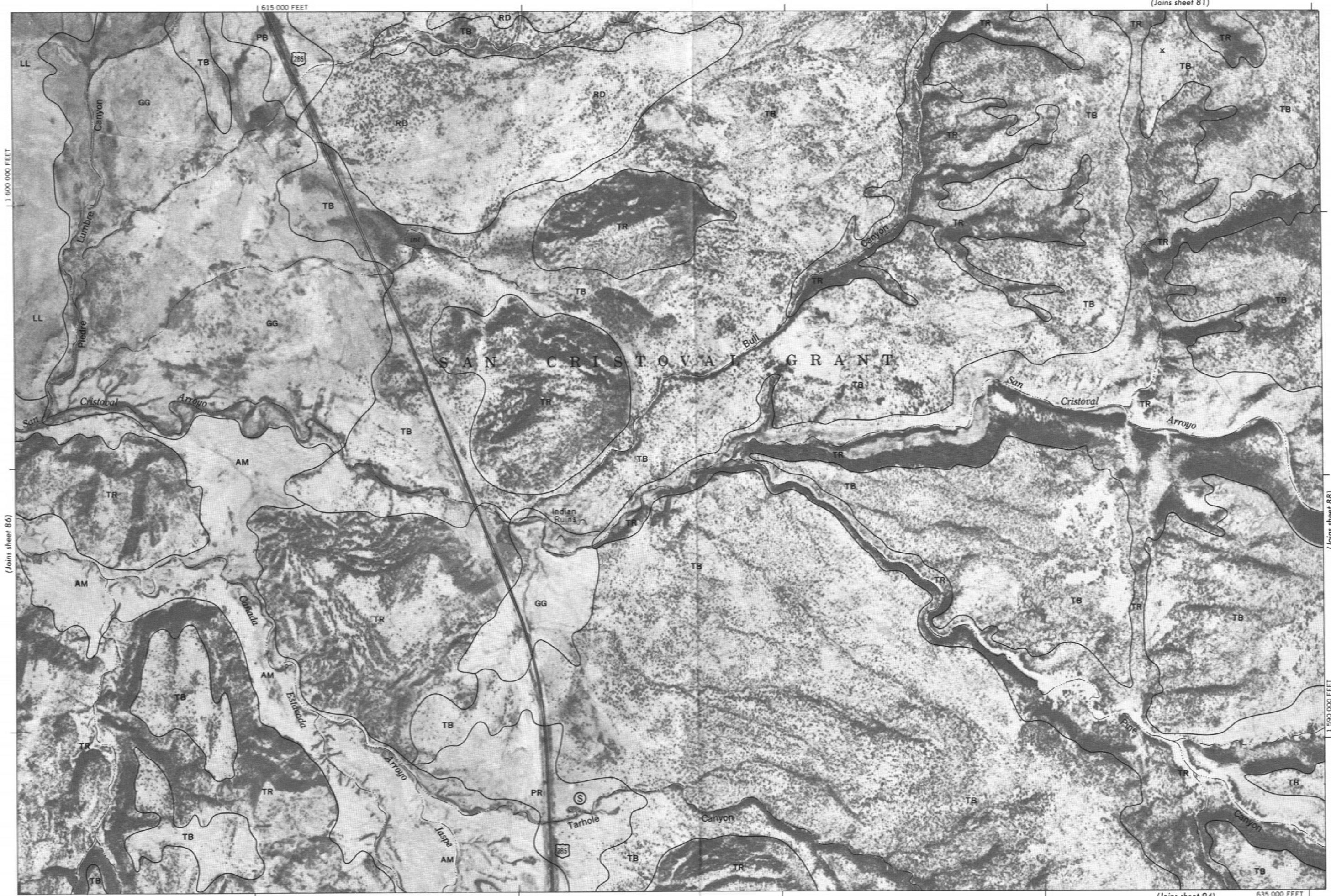
T. 14 N.

T. 13 N.

(Joins sheet 87)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
 the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
 This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





(Joins sheet 88)

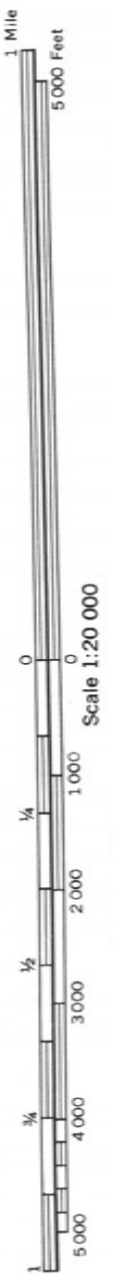
(Joins sheet 94)

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 86)



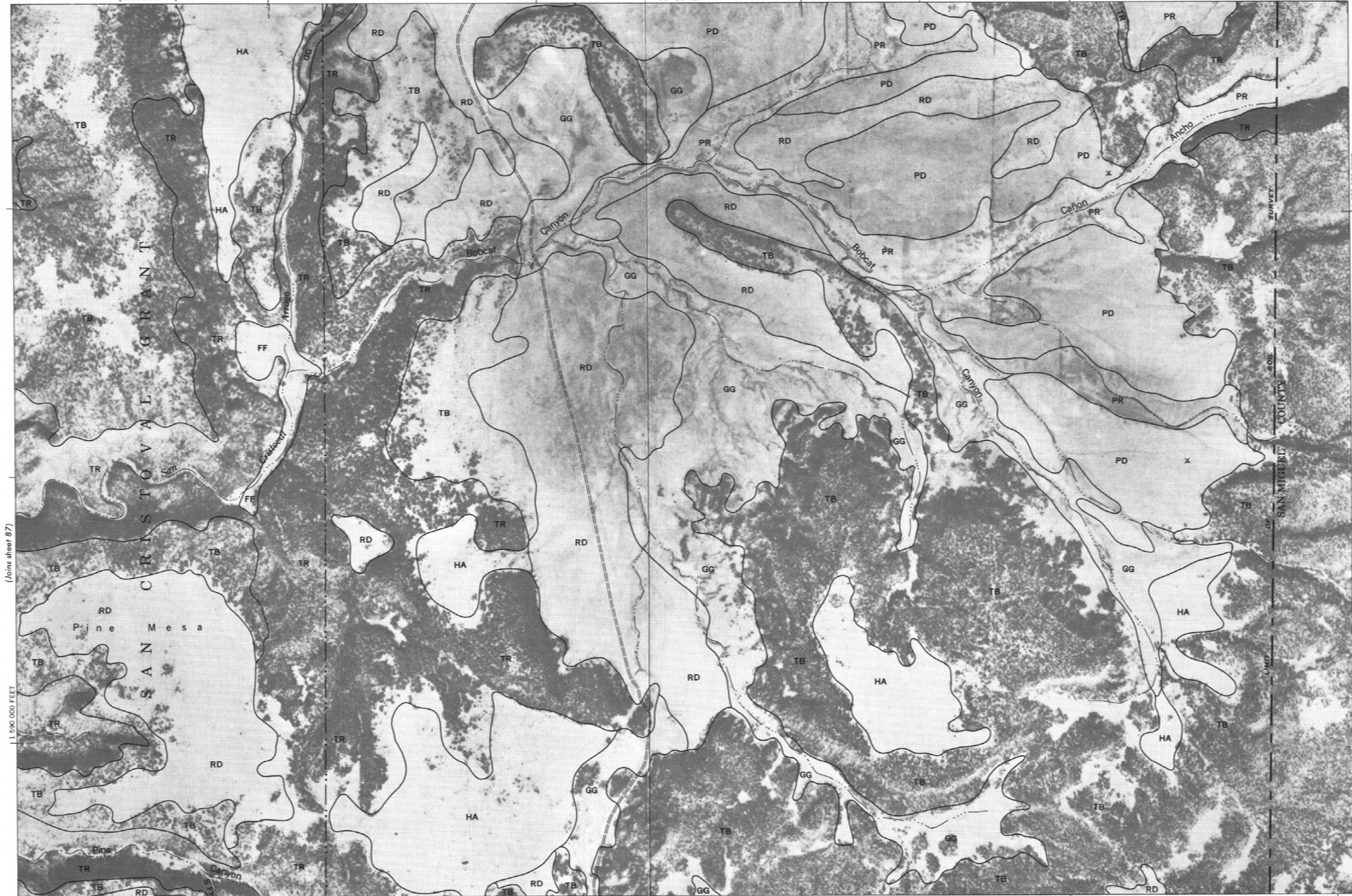
(Joins sheet 82)



Scale 1:20 000

(Joins sheet 87)

1 590 000 FEET



(Joins sheet 95)

640 000 FEET

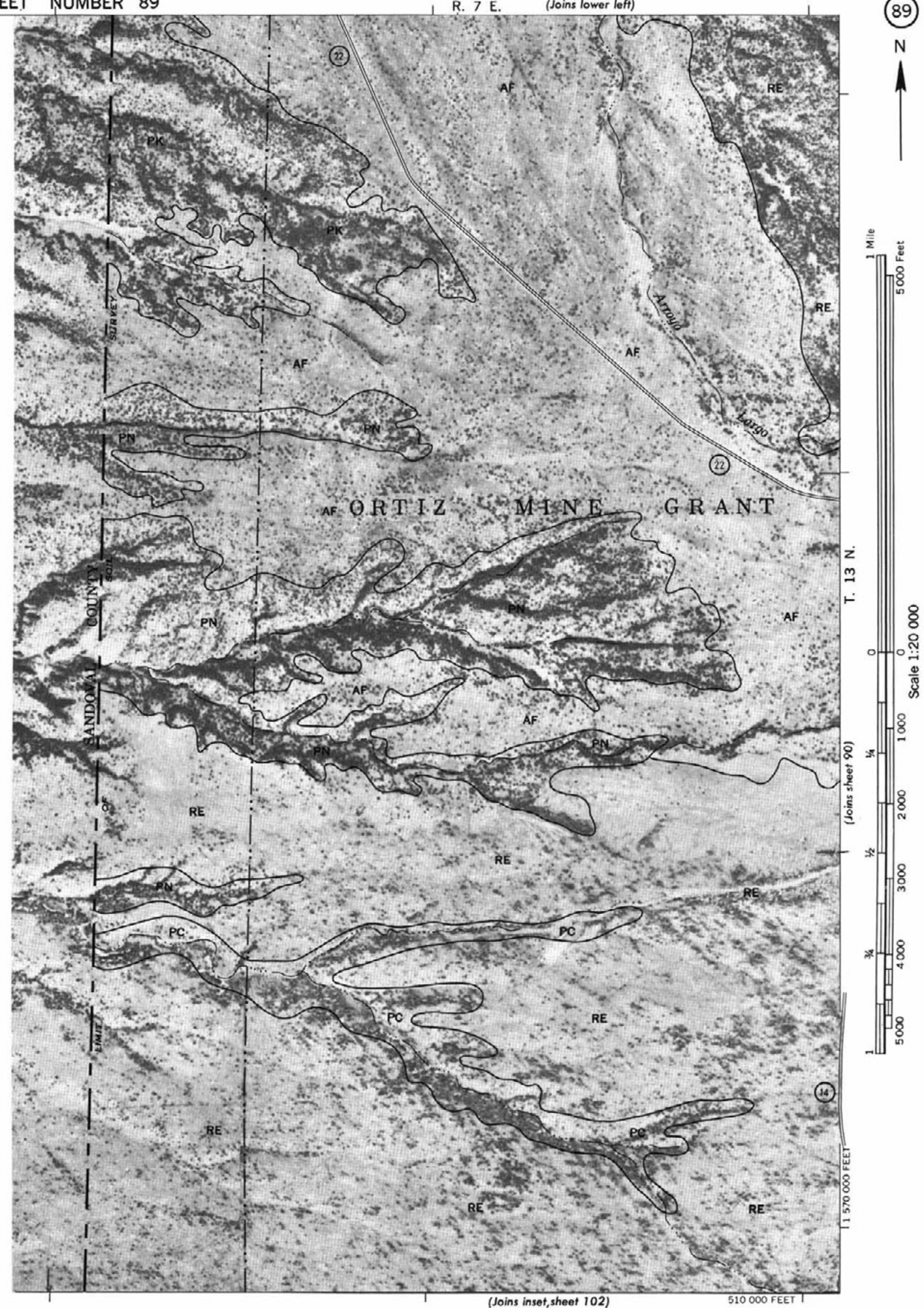
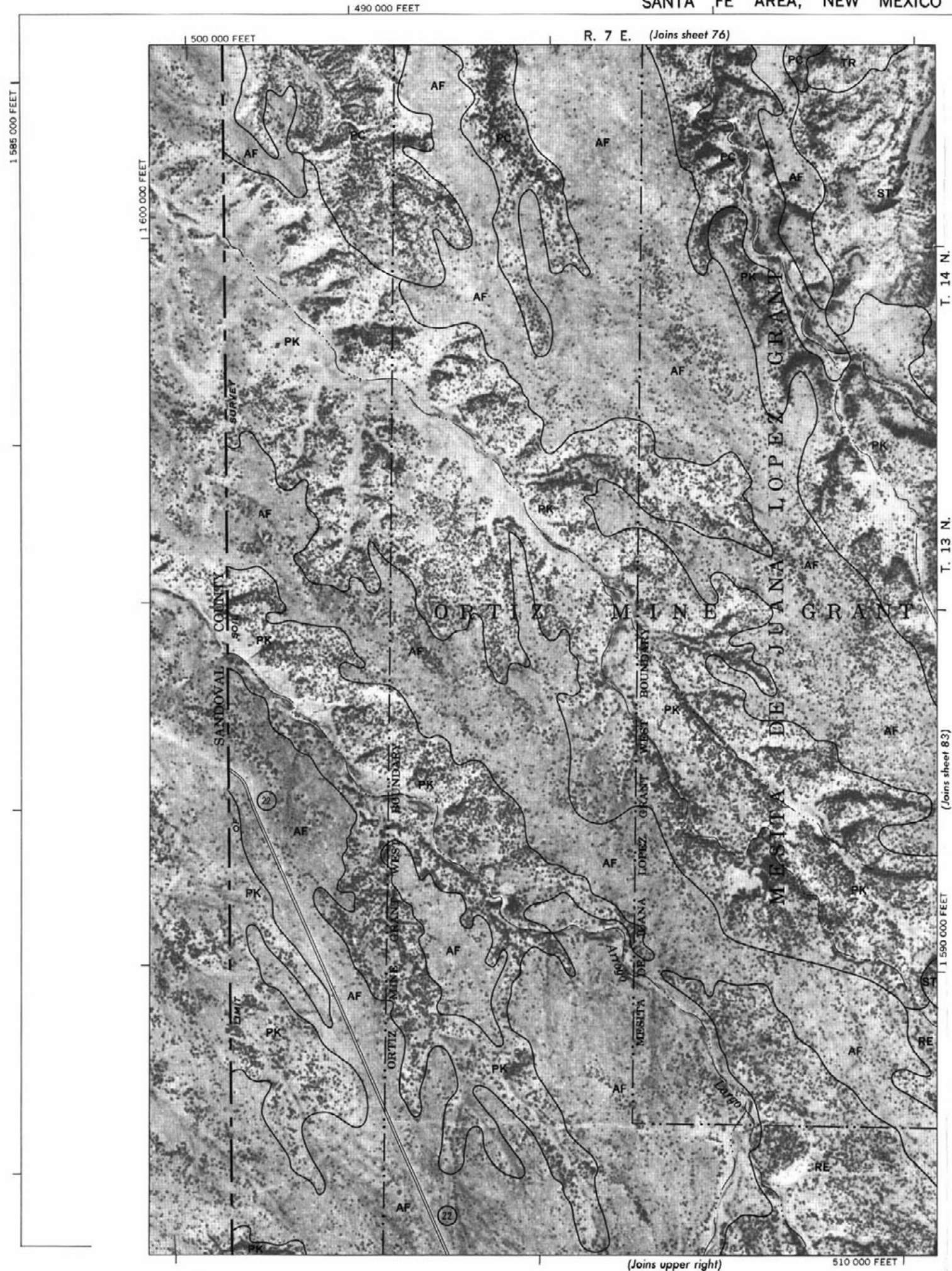
T. 14 N.

T. 13 N.

1 600 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

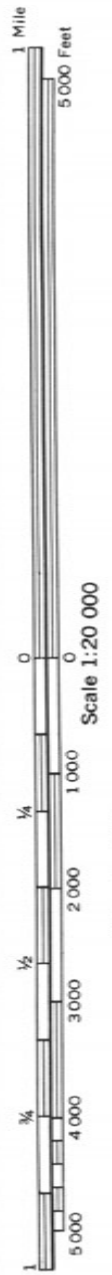






(Joins sheet 83)

535 000 FEET



(Joins sheet 89)

(Joins sheet 91)

1 570 000 FEET

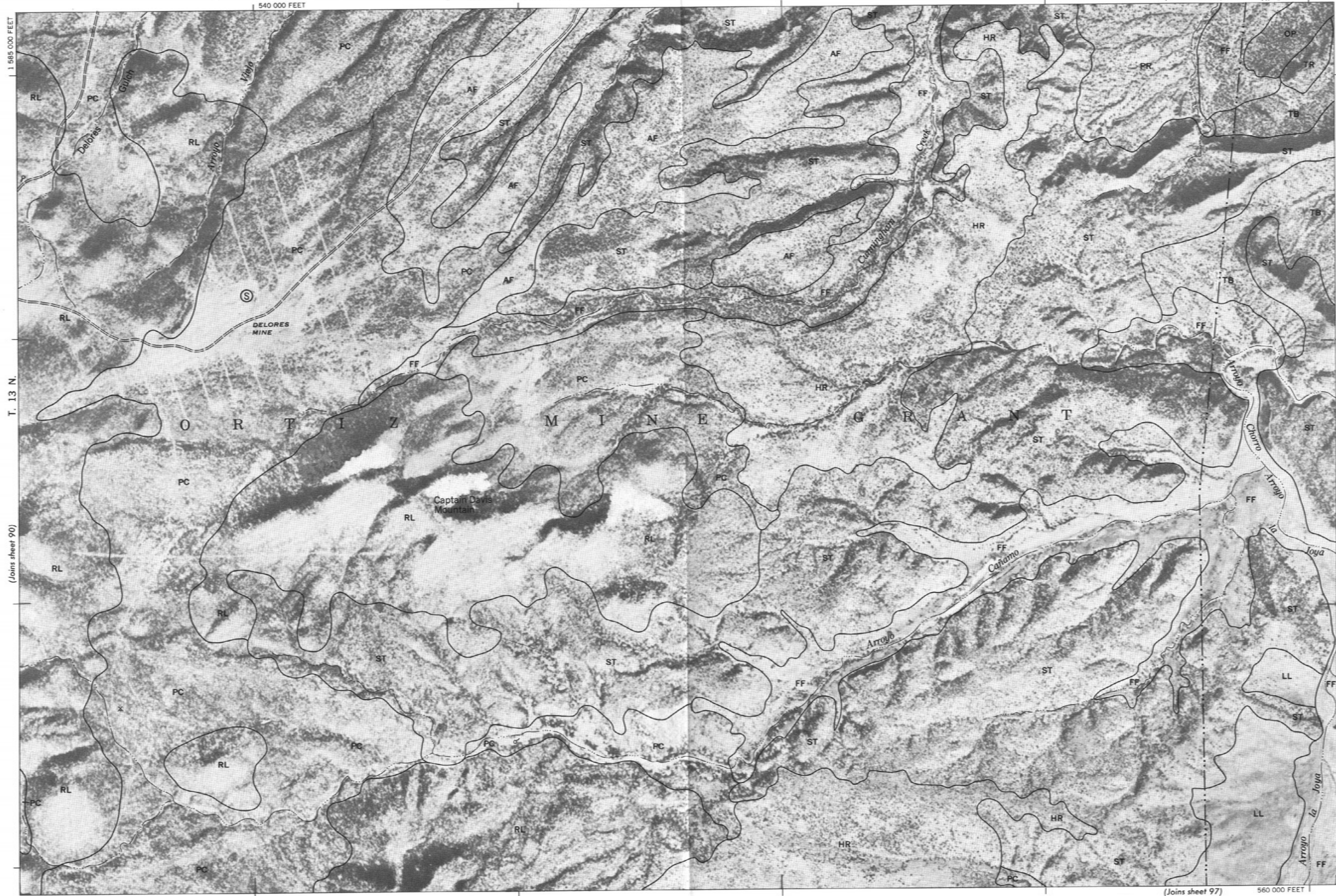
(Joins sheet 96)

515 000 FEET

Photobase from 1953, 1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



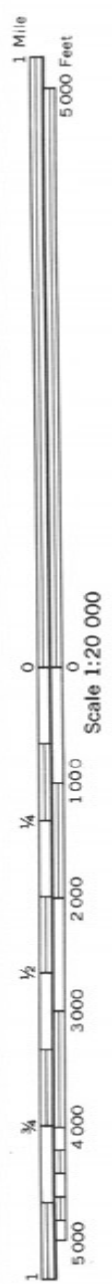
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



(Joins sheet 92)

Scale 1:20 000

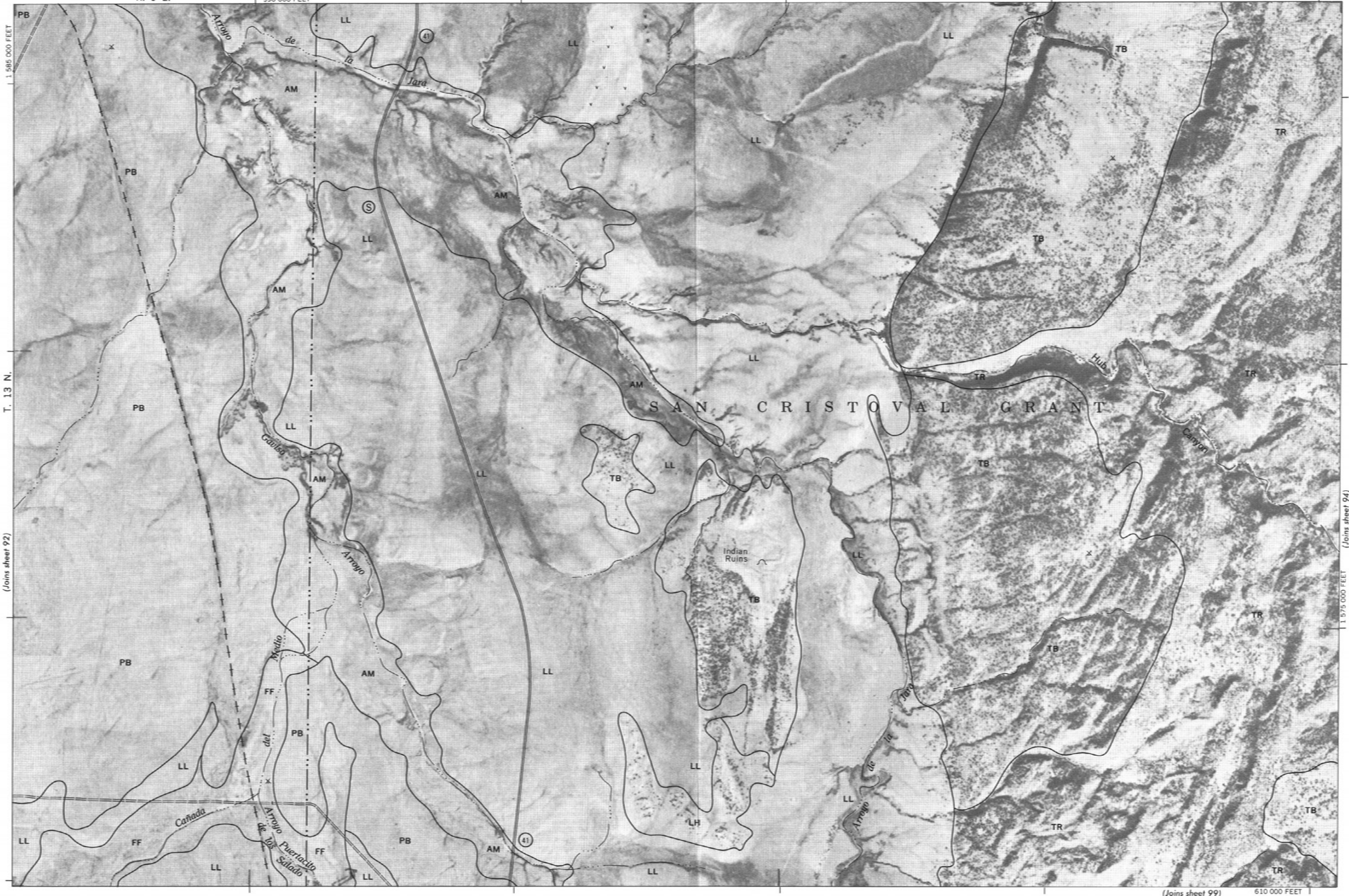




Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



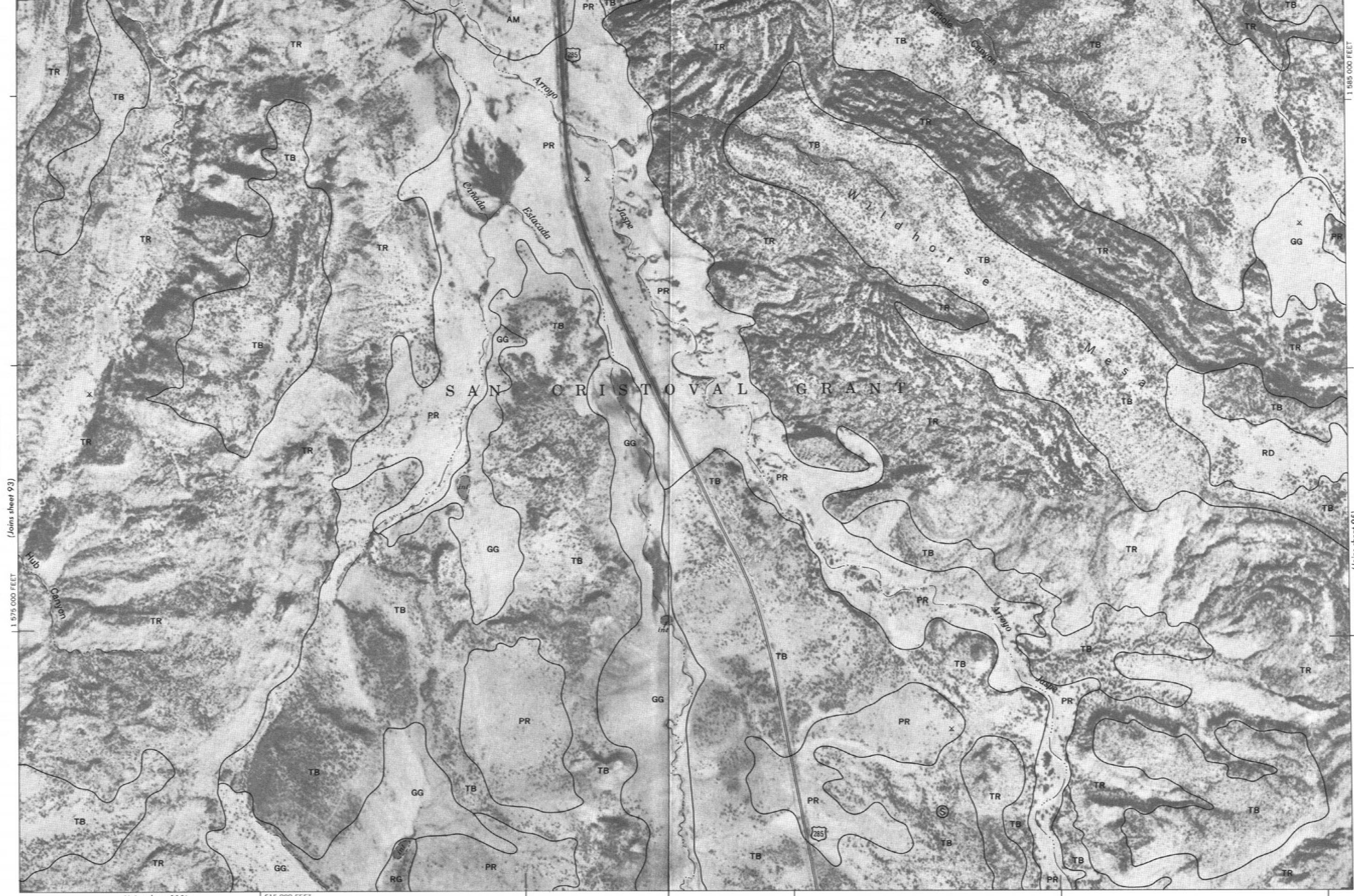
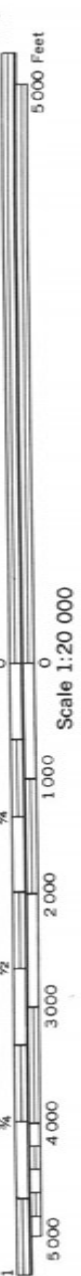
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone. 1927 North American datum.





(Joins sheet 87)

635 000 FEET



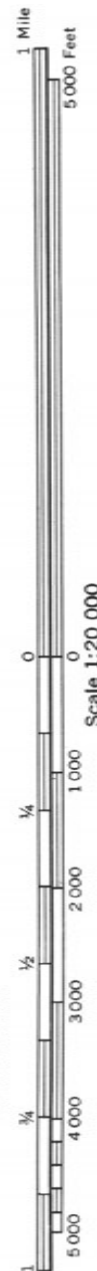
(Joins sheet 100)

615 000 FEET

(Joins sheet 95)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





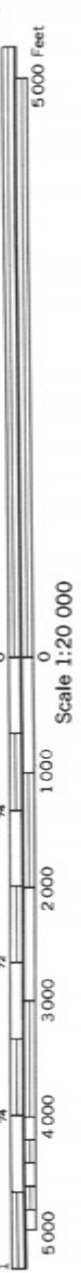
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.





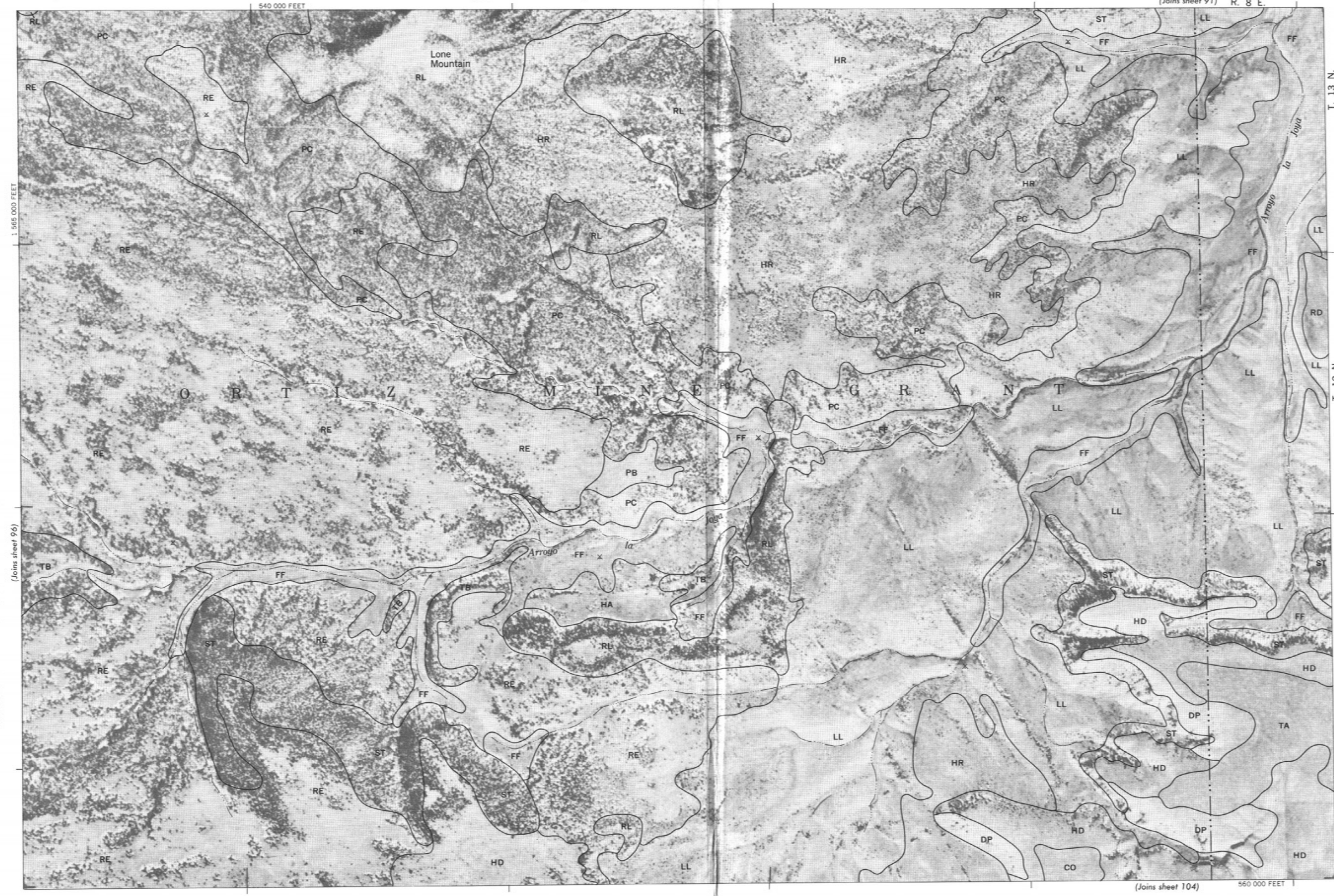
(Joins sheet 90)

535 000 FEET



Photobase from 1963-1964 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





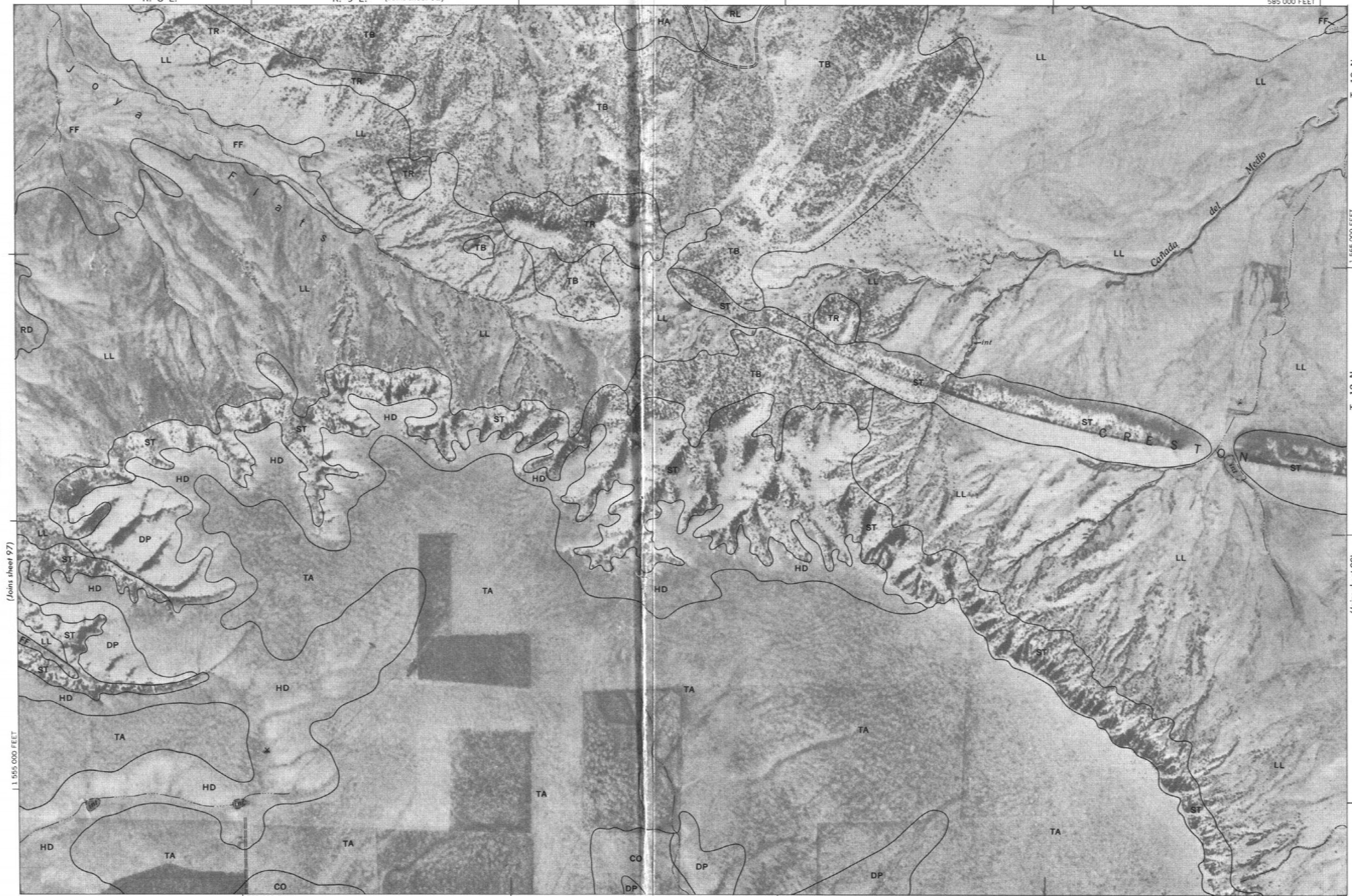
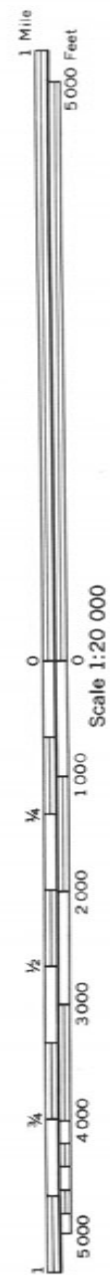
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photomaps from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 96)

(Joins sheet 98)

(Joins sheet 104)

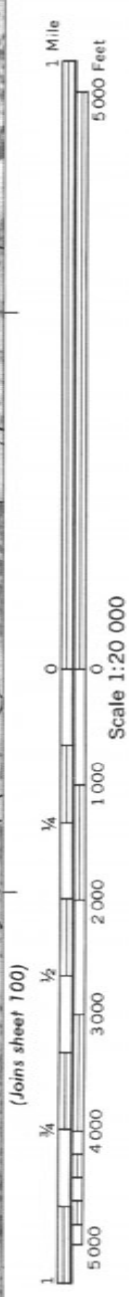
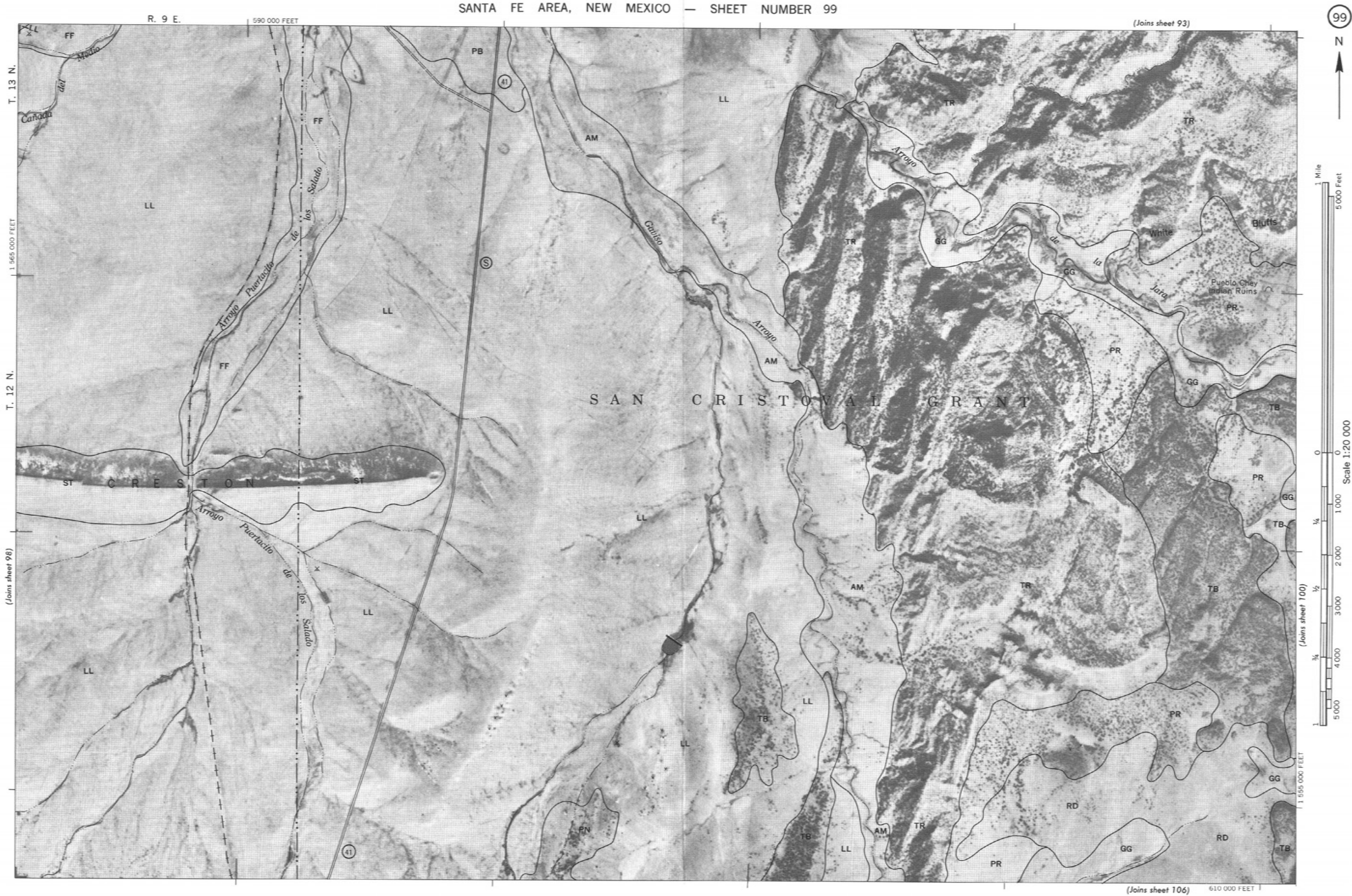




Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



(Joins sheet 98)

(Joins sheet 100)

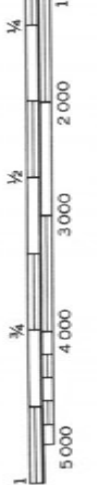
(Joins sheet 106)





1 Mile  
5 000 Feet

Scale 1:20 000



(Joins sheet 99)

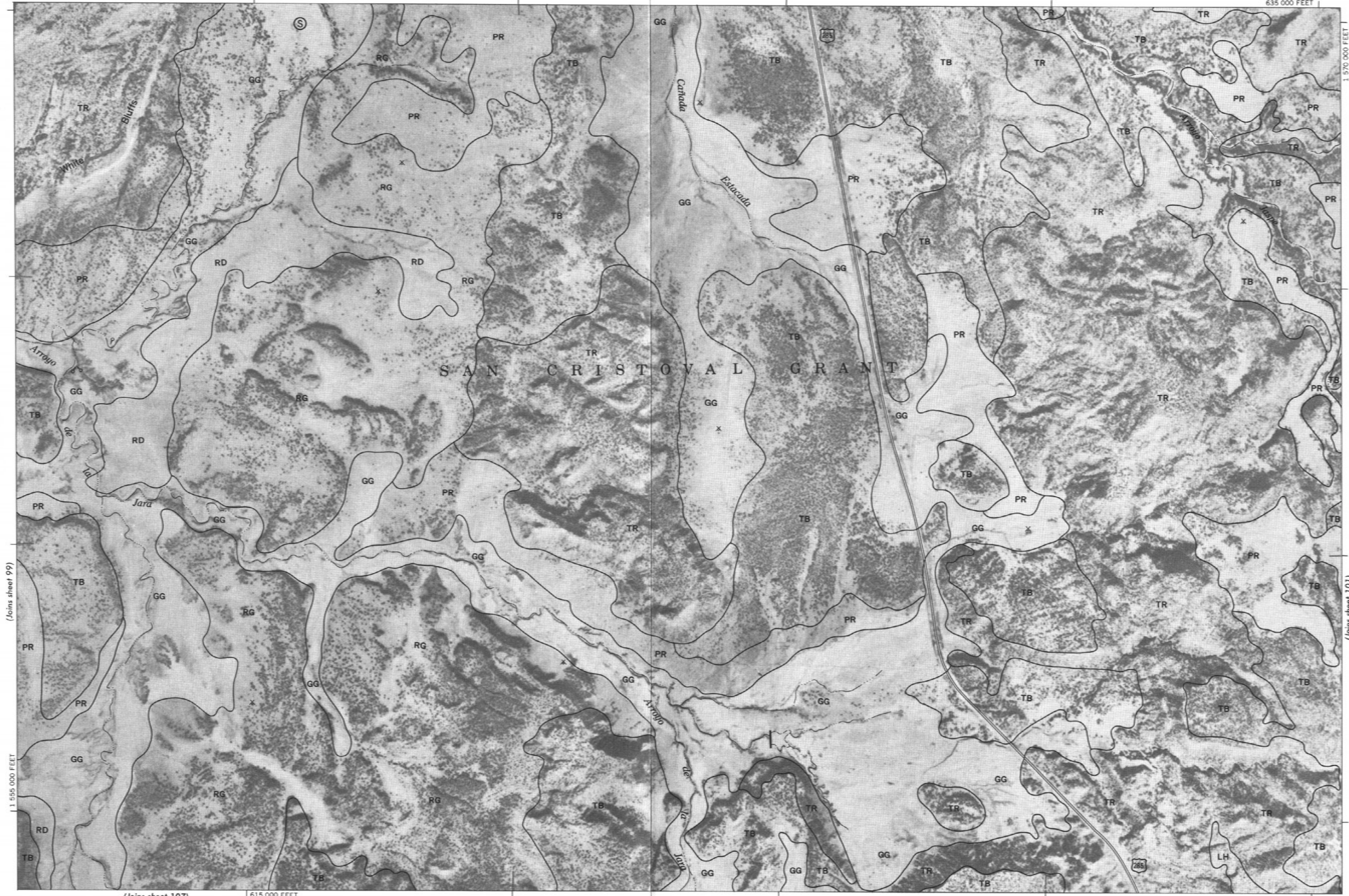
1 555 000 FEET

(Joins sheet 107)

615 000 FEET

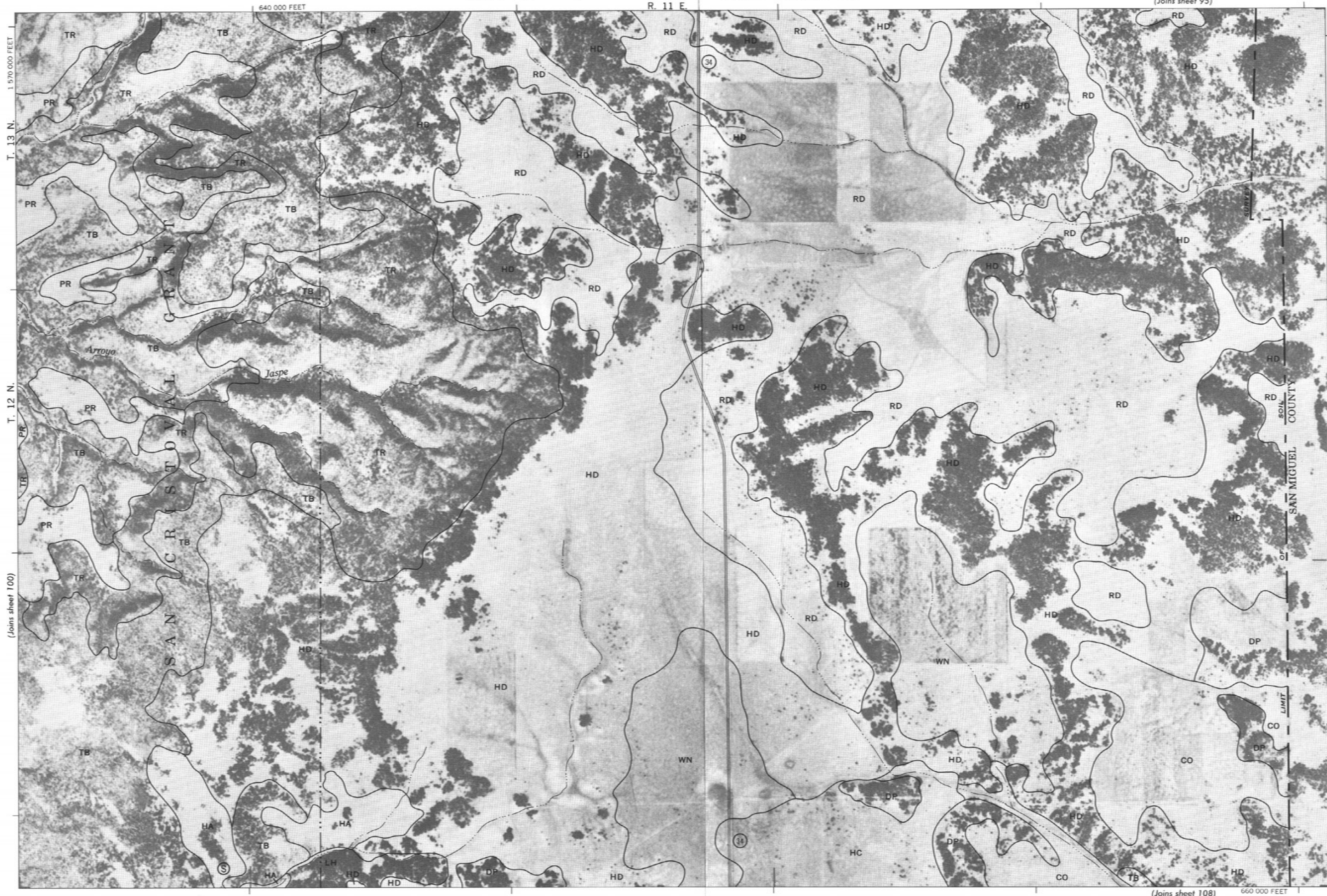
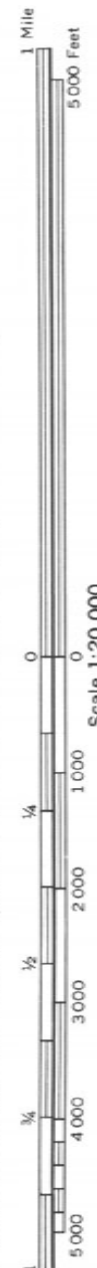
(Joins sheet 101)

1 570 000 FEET



Photobase from 1963-1964 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.





(Joins sheet 100)

T. 12 N.

T. 13 N.

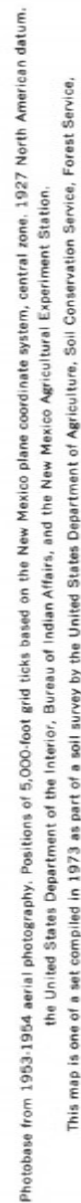
R. 11 E.

640 000 FEET

1 555 000 FEET

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

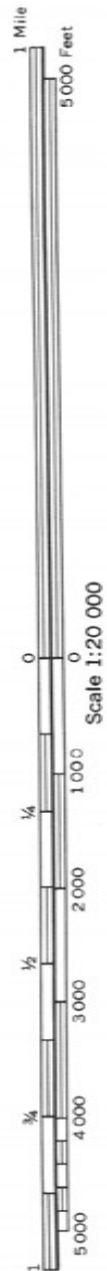












1 560 000 FEET

T. 12 N.

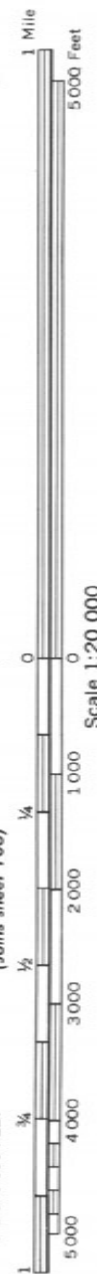
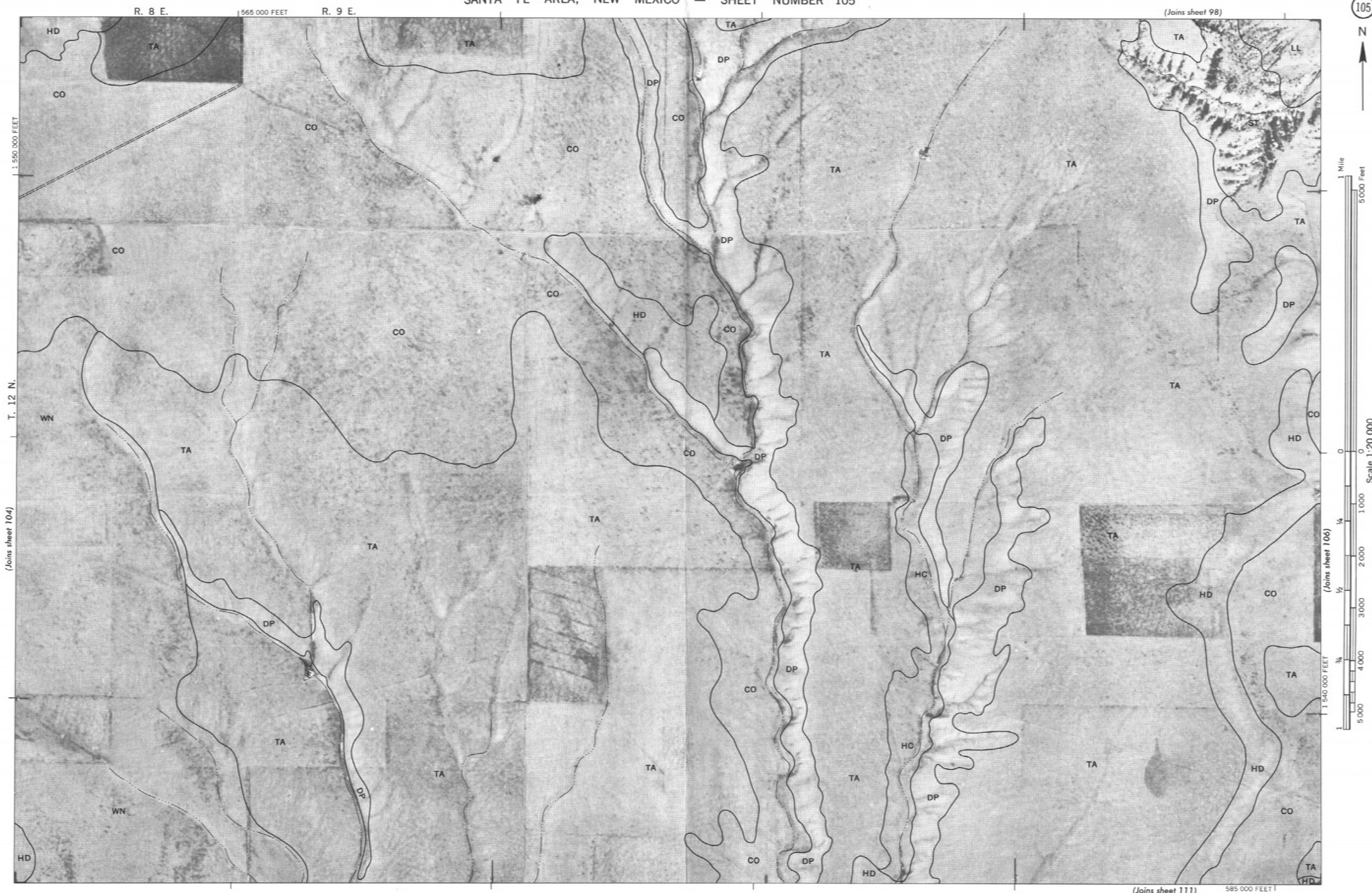
(Joins sheet 105)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

SANTA FE AREA, NEW MEXICO



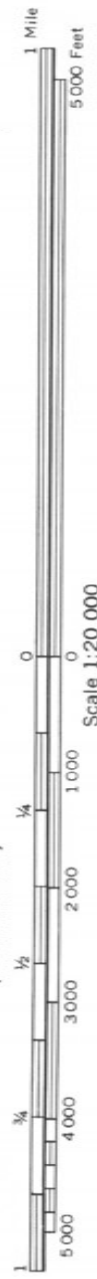
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.









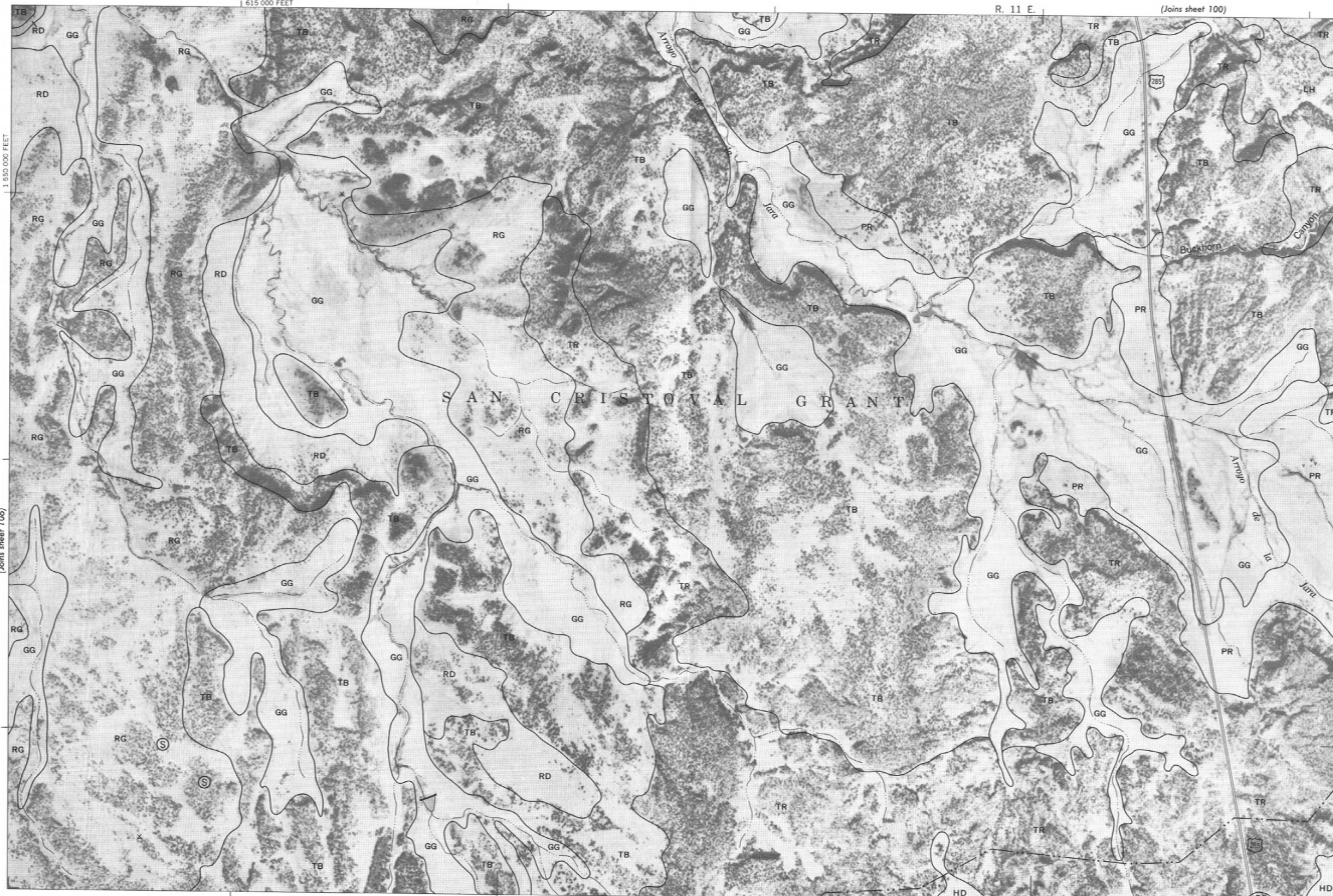


(Joins sheet 108)

T. 12 N.

(Joins sheet 113)

635 000 FEET



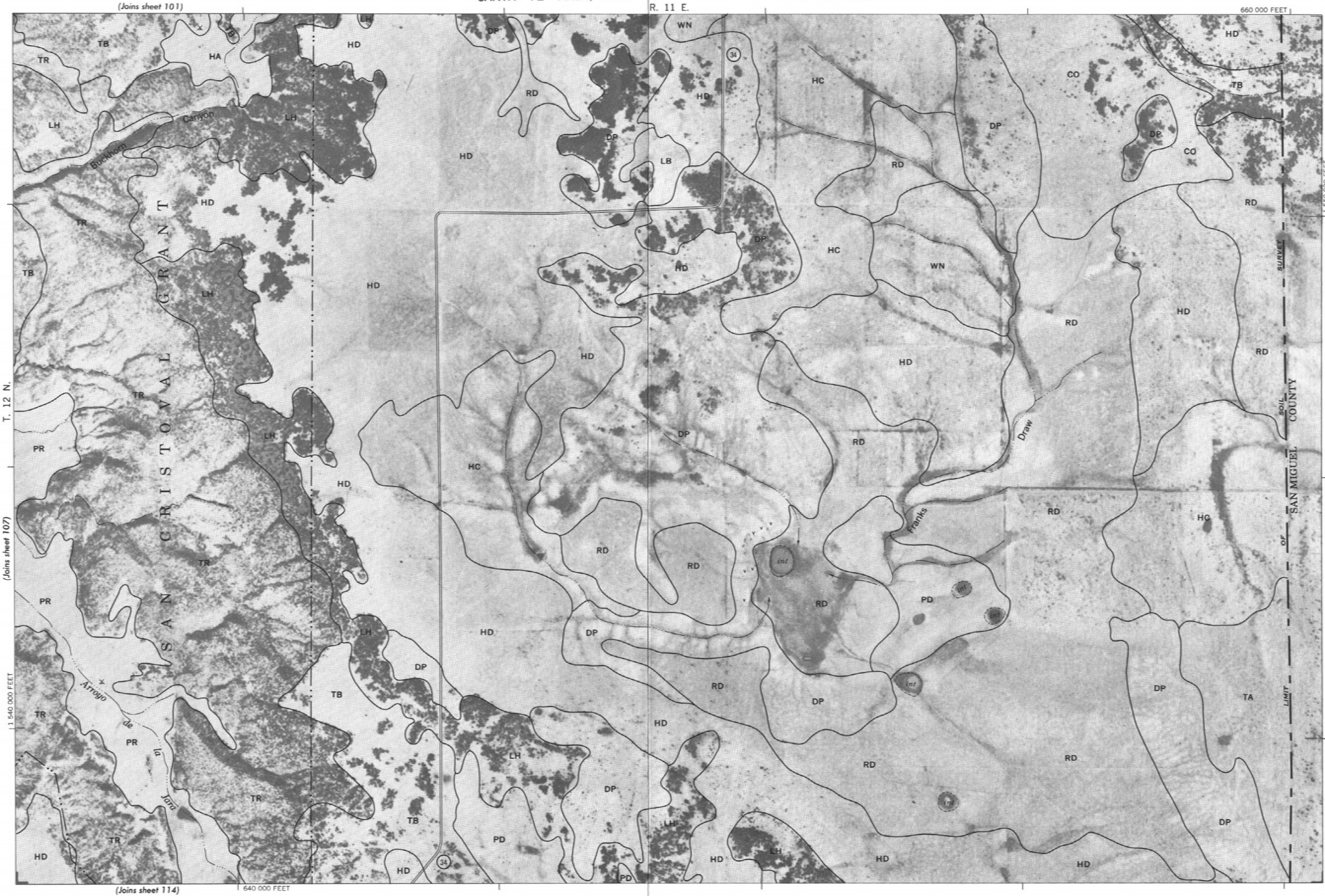
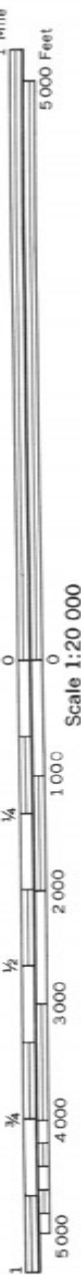
1 550 000 FEET

(Joins sheet 106)

615 000 FEET

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.





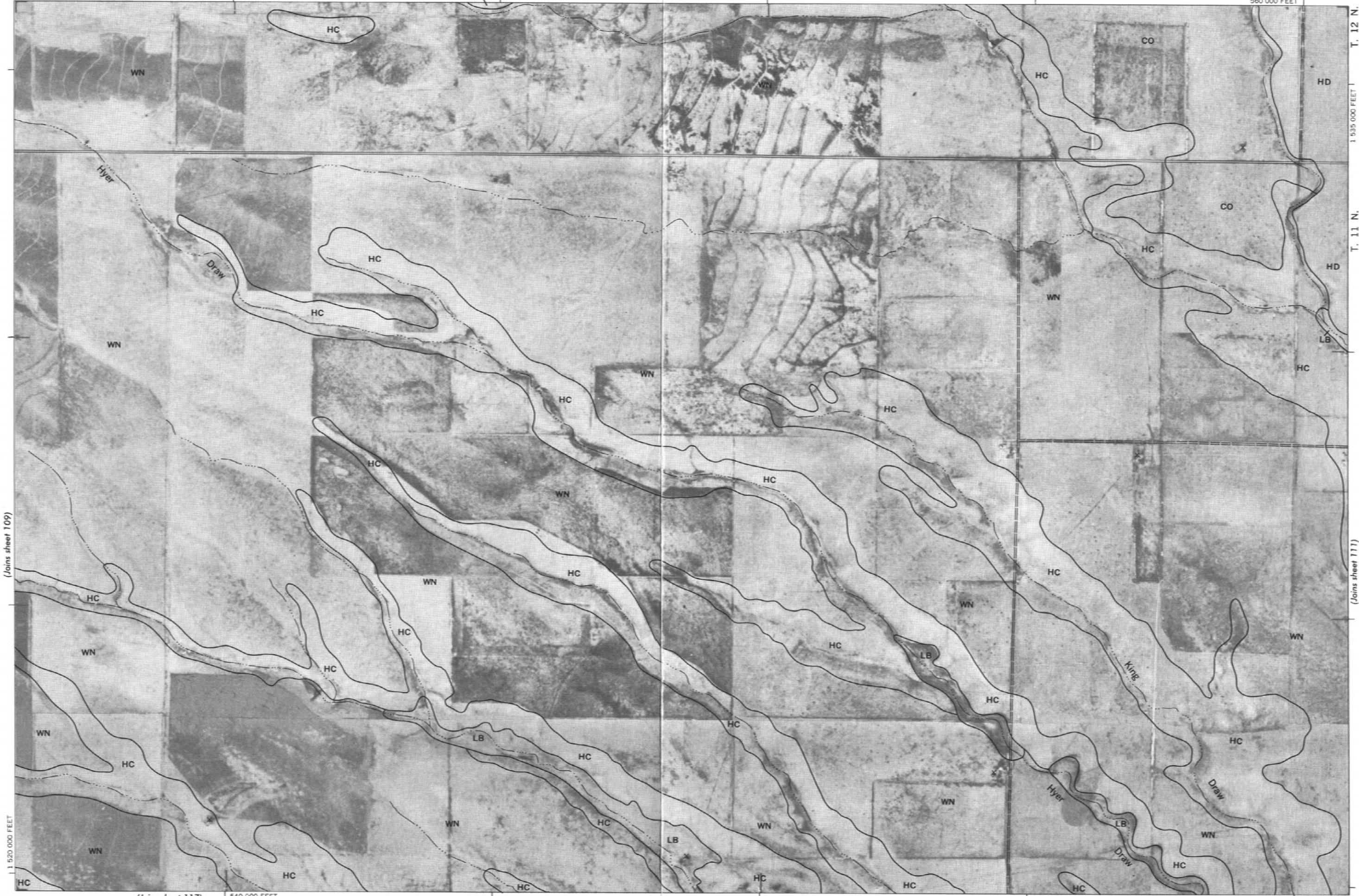
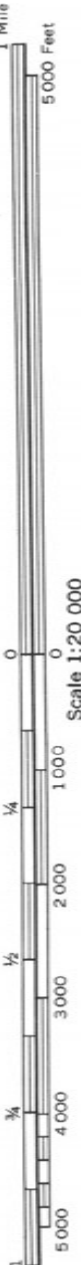
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



(Joins inset, sheet 115)







1 520 000 FEET

(Joins sheet 117)

540 000 FEET

1 535 000 FEET

T. 11 N.

T. 12 N.

(Joins sheet 111)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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SANTA FE AREA, NEW MEXICO NO. 110



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



(Joins sheet 112)

1 Mile

5,000 Feet

Scale 1:20 000

(Joins sheet 118)

585 000 FEET



(Joins sheet 106)

R. 9 E.

R. 10 E.

610 000 FEET



1 525 000 FEET

(Joins sheet 111)

Scale 1:20 000

(Joins sheet 119)

1 525 000 FEET

1 525 000 FEET

1 525 000 FEET

1 525 000 FEET



(Joins sheet 113)

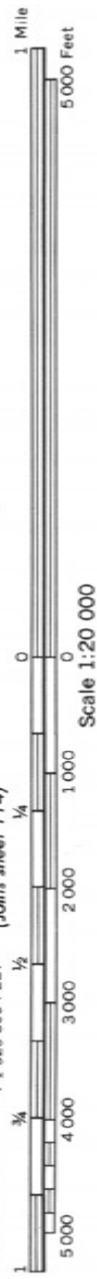
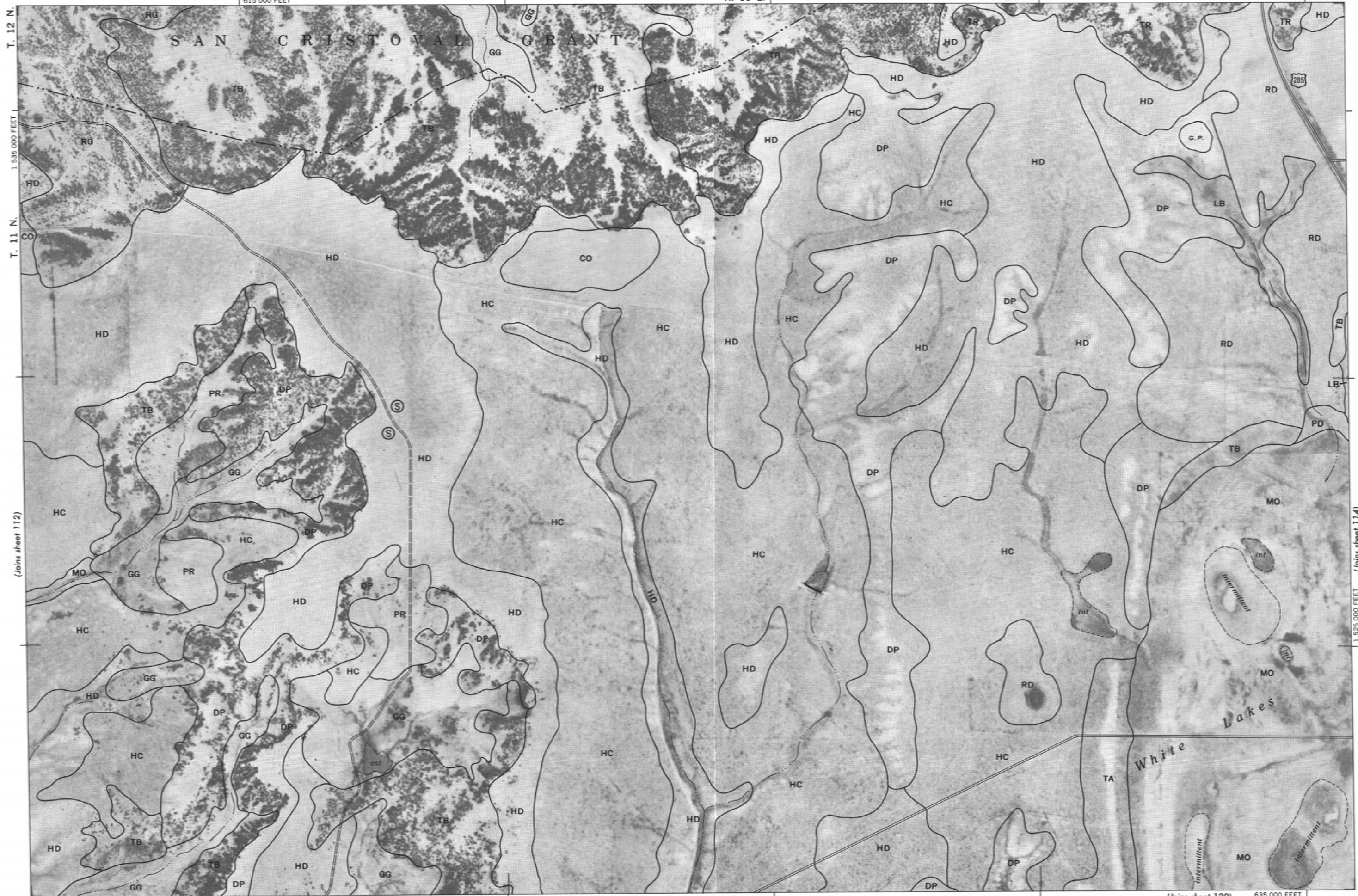
T. 11 N.

T. 12 N.

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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660 000 FEET |

T. 12 N.

T. 11 N.

A scale bar with two segments. The top segment is labeled "1 Mile" and the bottom segment is labeled "5,000 Feet".

Scale 1:20 000

(Joins sheet 113)

1 525 000 FEET

(Joins sheet 121)

640 000 FEET

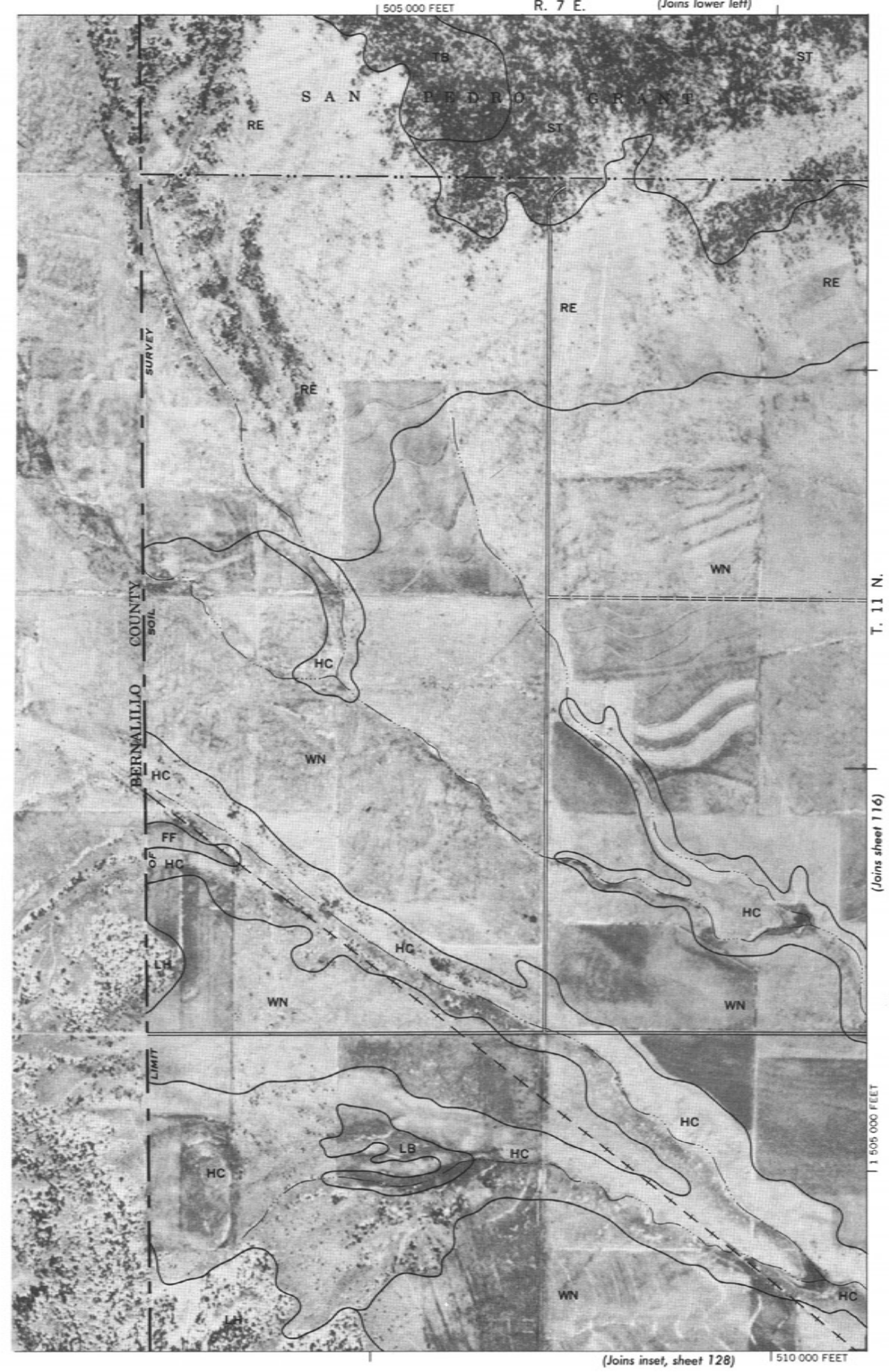
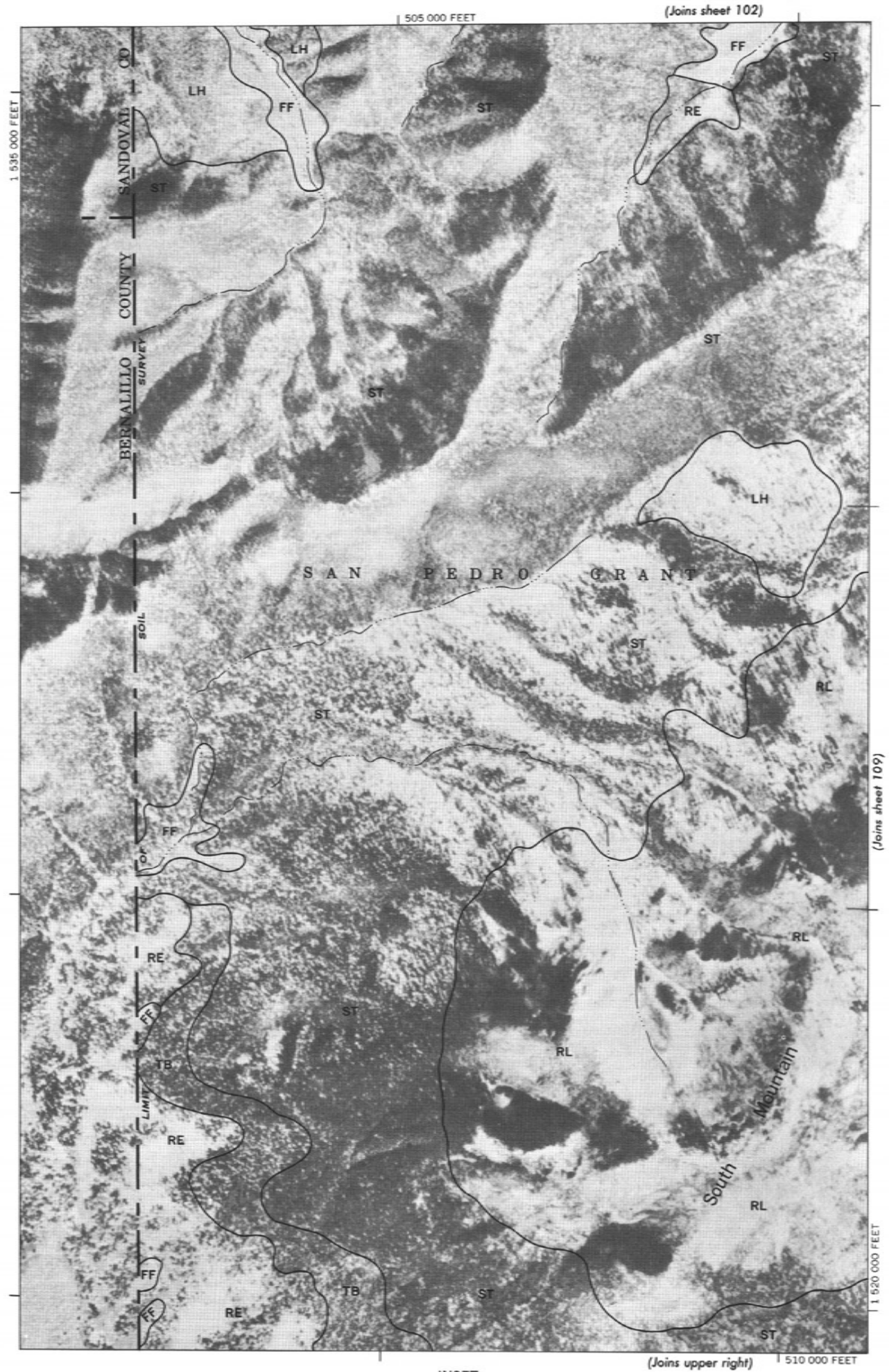
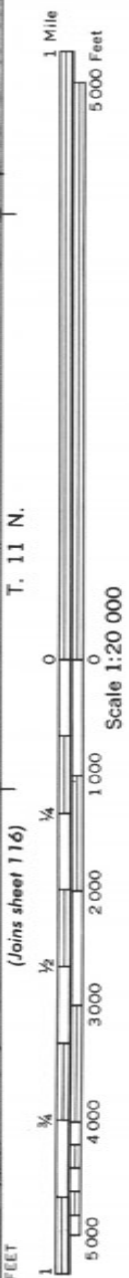
**SAN MIGUEL** **COUNTY** **SOIL**

Y

Photobase from 1953:1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service,





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(Joins sheet 109)



1 Mile  
5 000 Feet

Scale 1:20 000

(Joins sheet 115)

1 505 000 FEET

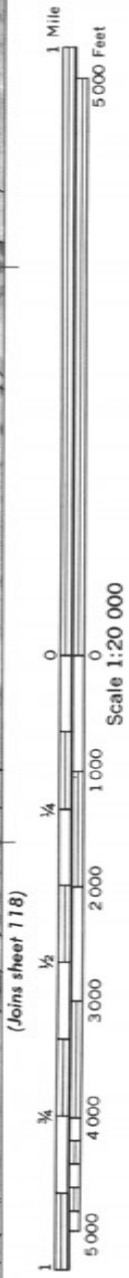
(Joins sheet 122)

515 000 FEET

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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Scale 1:20 000

(Joins sheet 117)

1 505 000 FEET

1 565 000 FEET

(Joins sheet 124)

1 515 000 FEET

T. 11 N.

(Joins sheet 119)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.

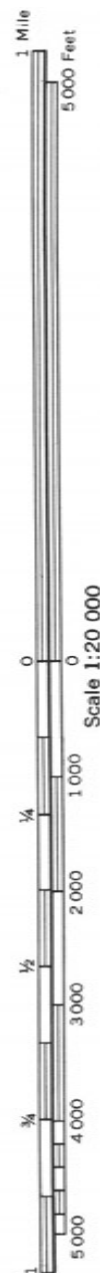


SANTA FE AREA, NEW MEXICO NO. 119  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.





(Joins sheet 113)

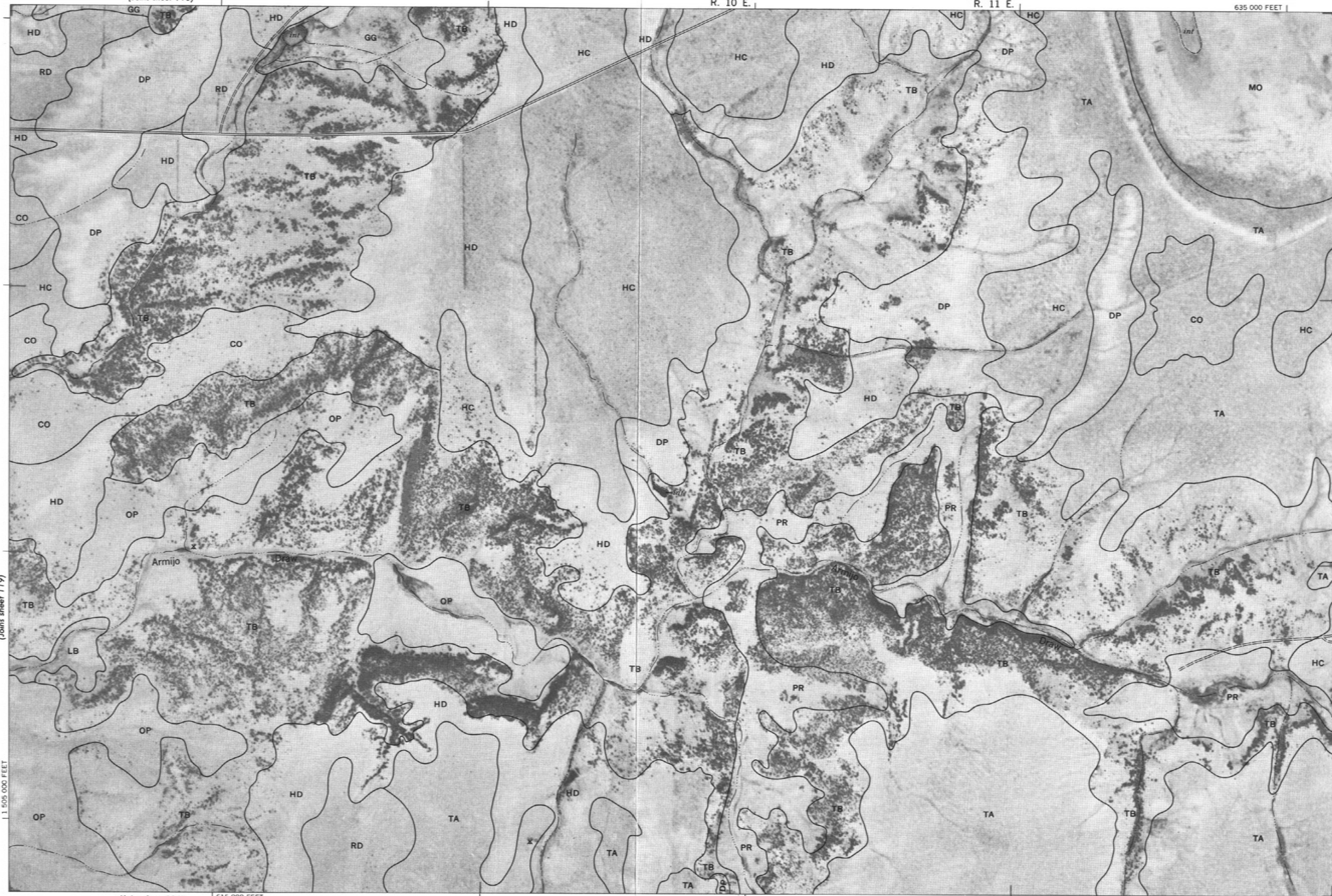


(Joins sheet 119)

1 505 000 FEET

(Joins sheet 126)

615 000 FEET



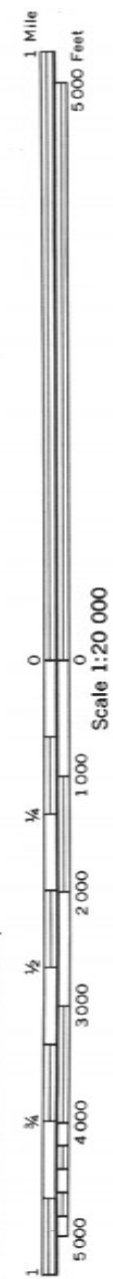
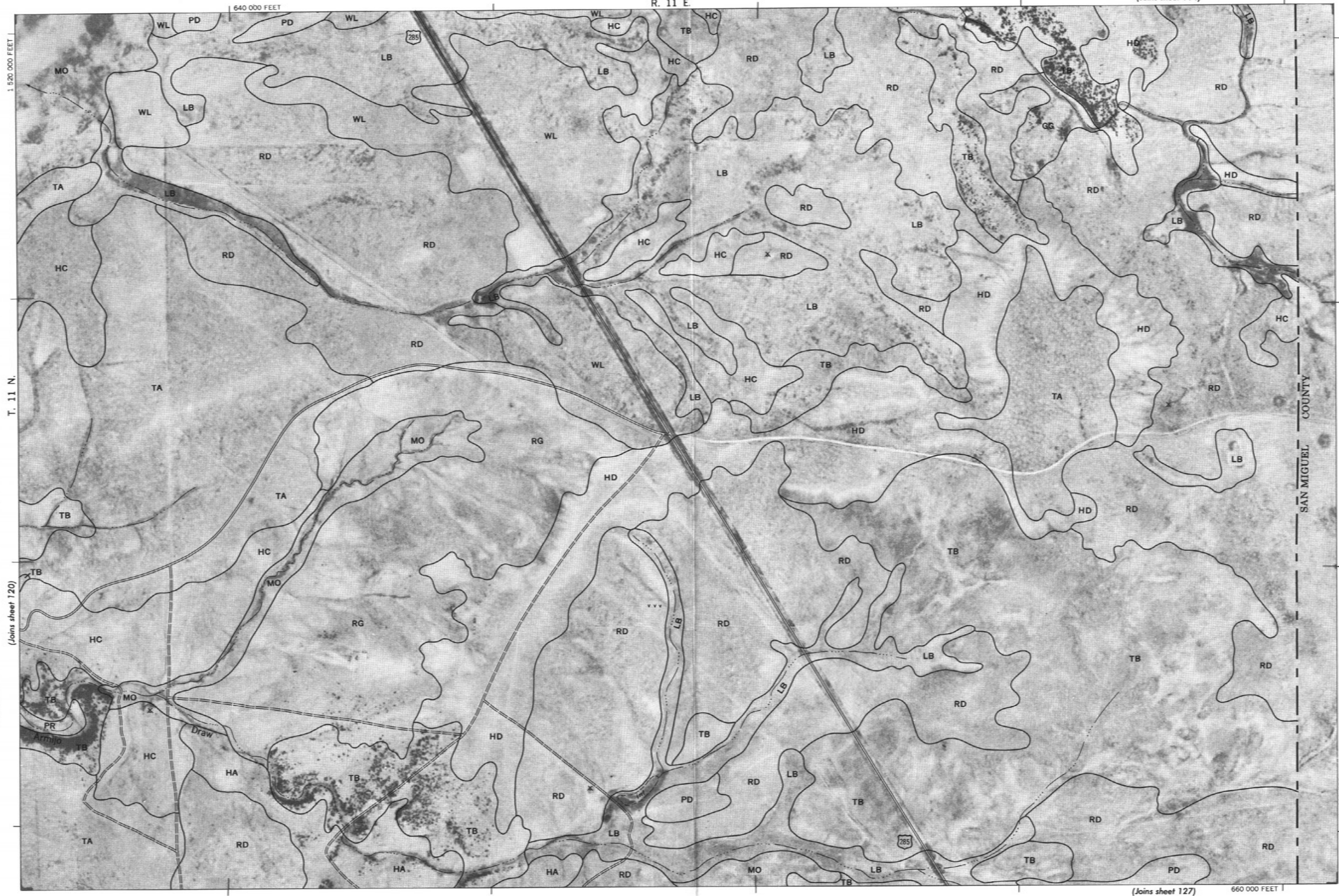
(Joins sheet 121)

T. 11 N.

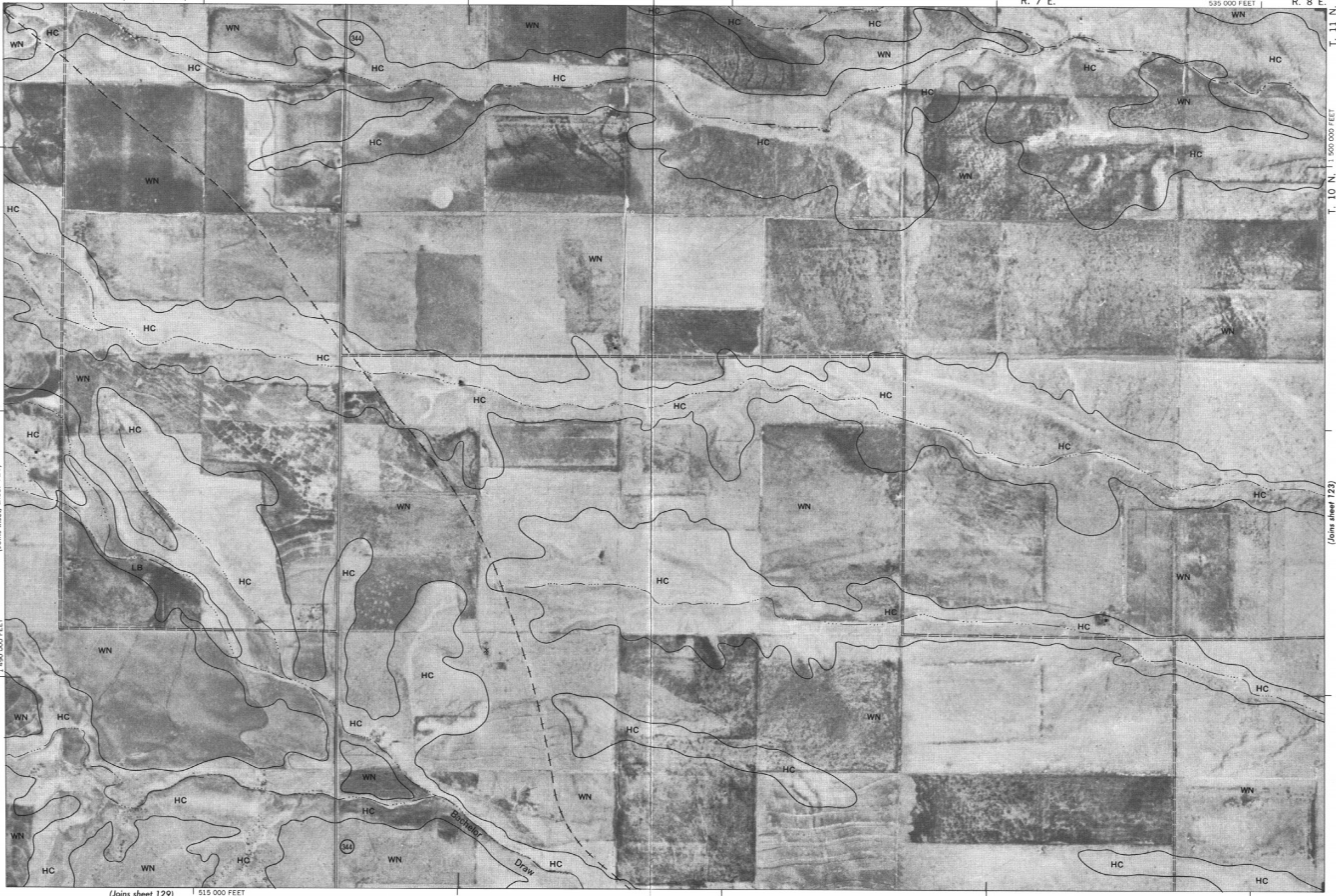
1 520 000 FEET



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.









This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

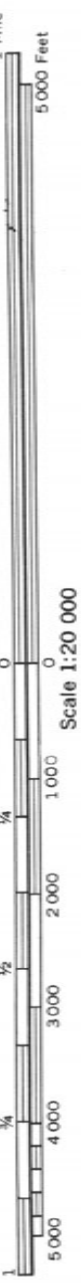


(Joins sheet 122)

(Joins sheet 124)

(Joins sheet 130)





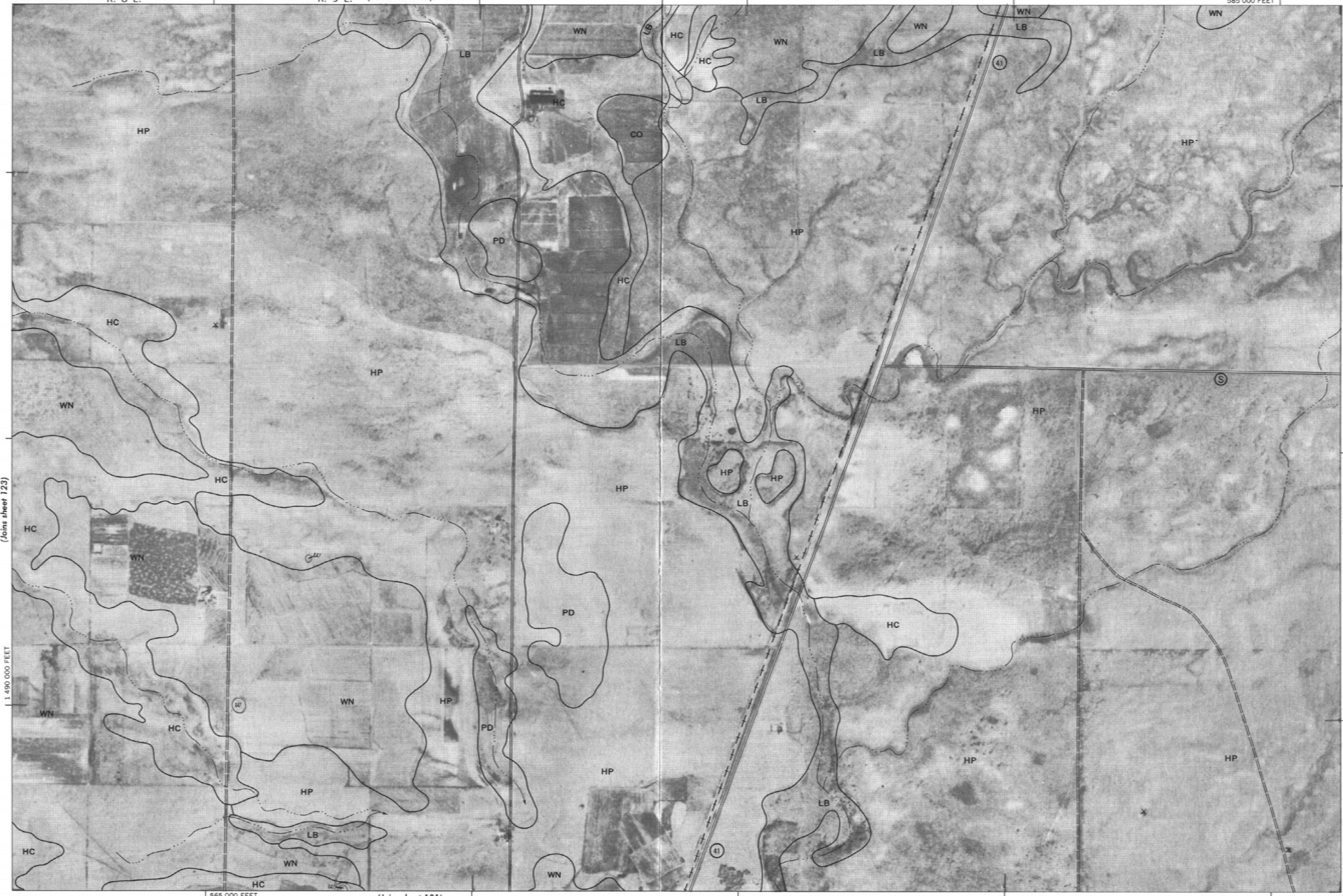
1 490 000 FEET

R. 8 E.

R. 9 E. (Joins sheet 118)

SANTA FE AREA, NEW MEXICO — SHEET NUMBER 124

585 000 FEET



565 000 FEET

(Joins sheet 131)

(Joins sheet 125)

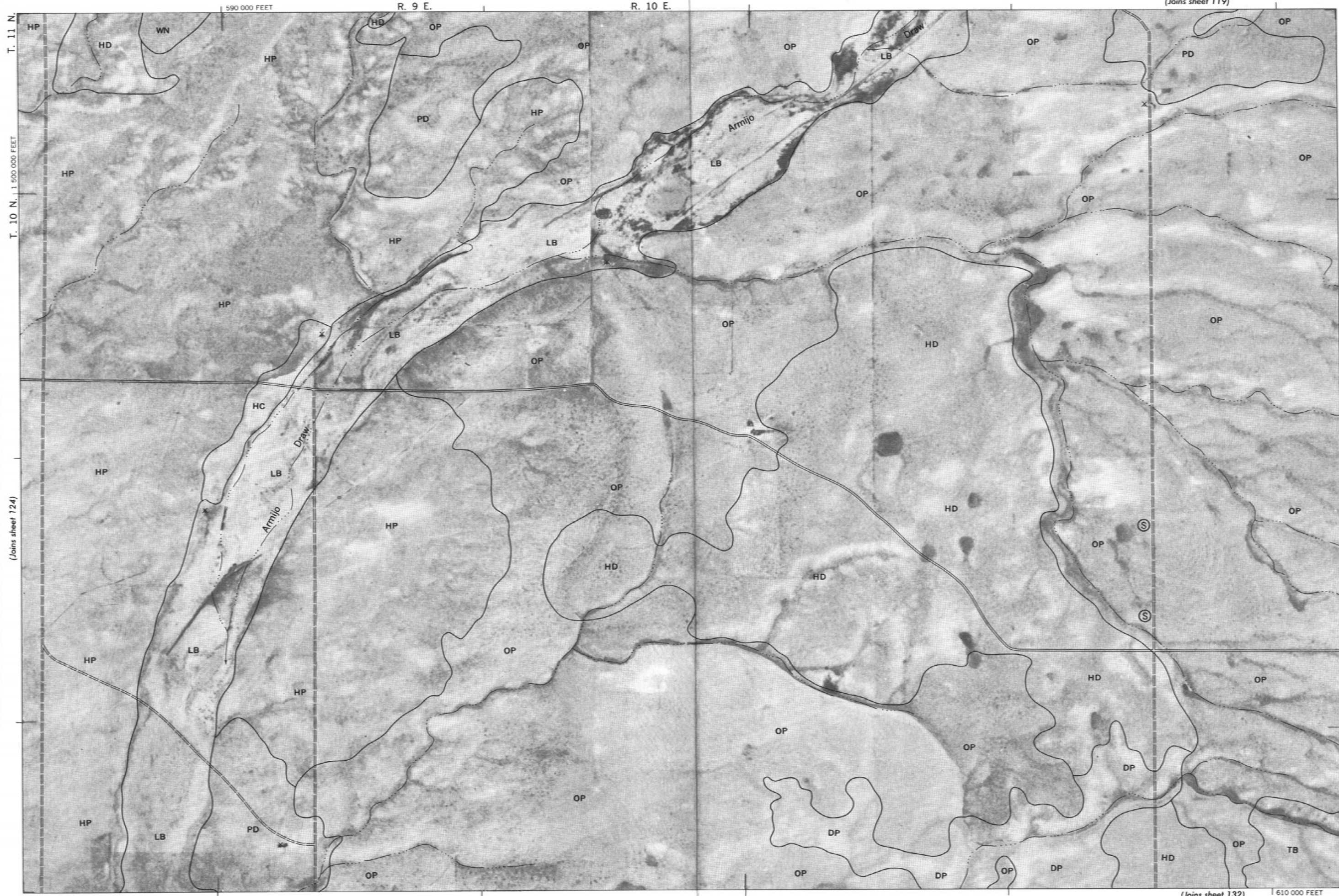
T. 10 N. 1 500 000 FEET

T. 11 N.

Photobase from 1963-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.



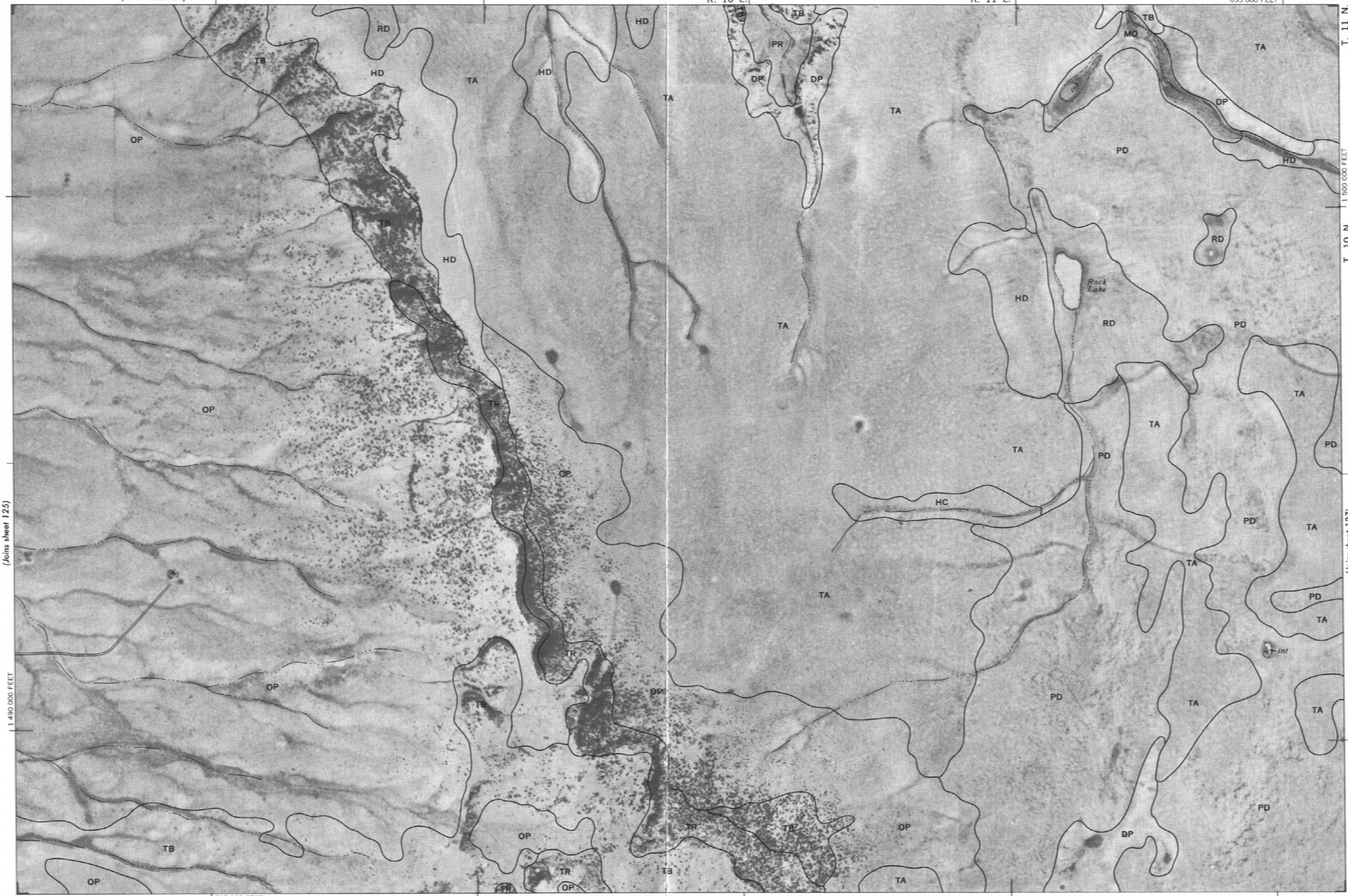
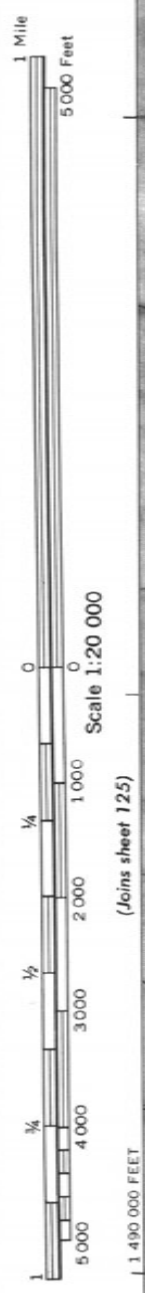
(Joins sheet 126)

1 490 000 FEET

610 000 FEET

(Joins sheet 132)

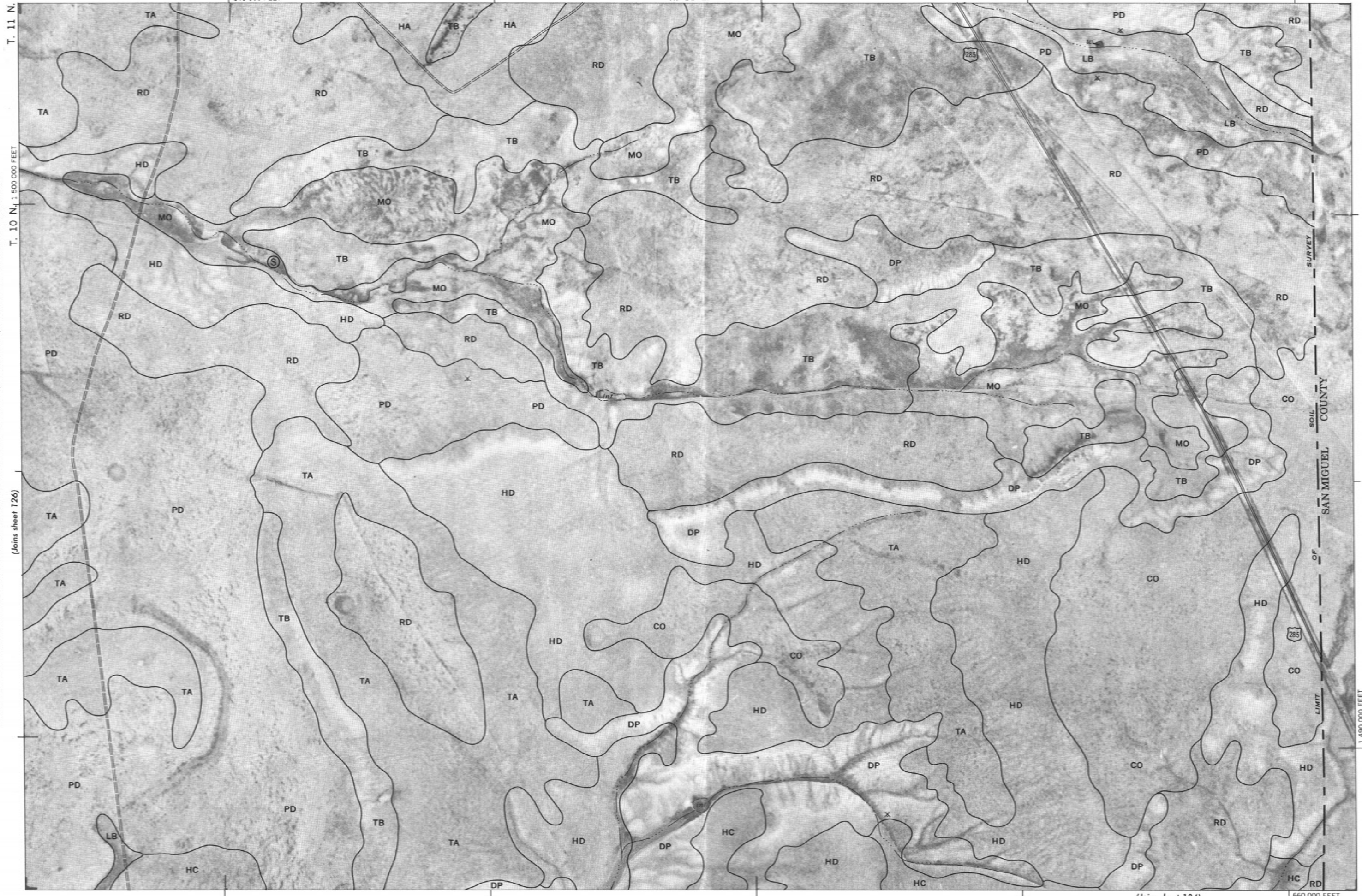








Scale 1:20 000





510 000 FEET

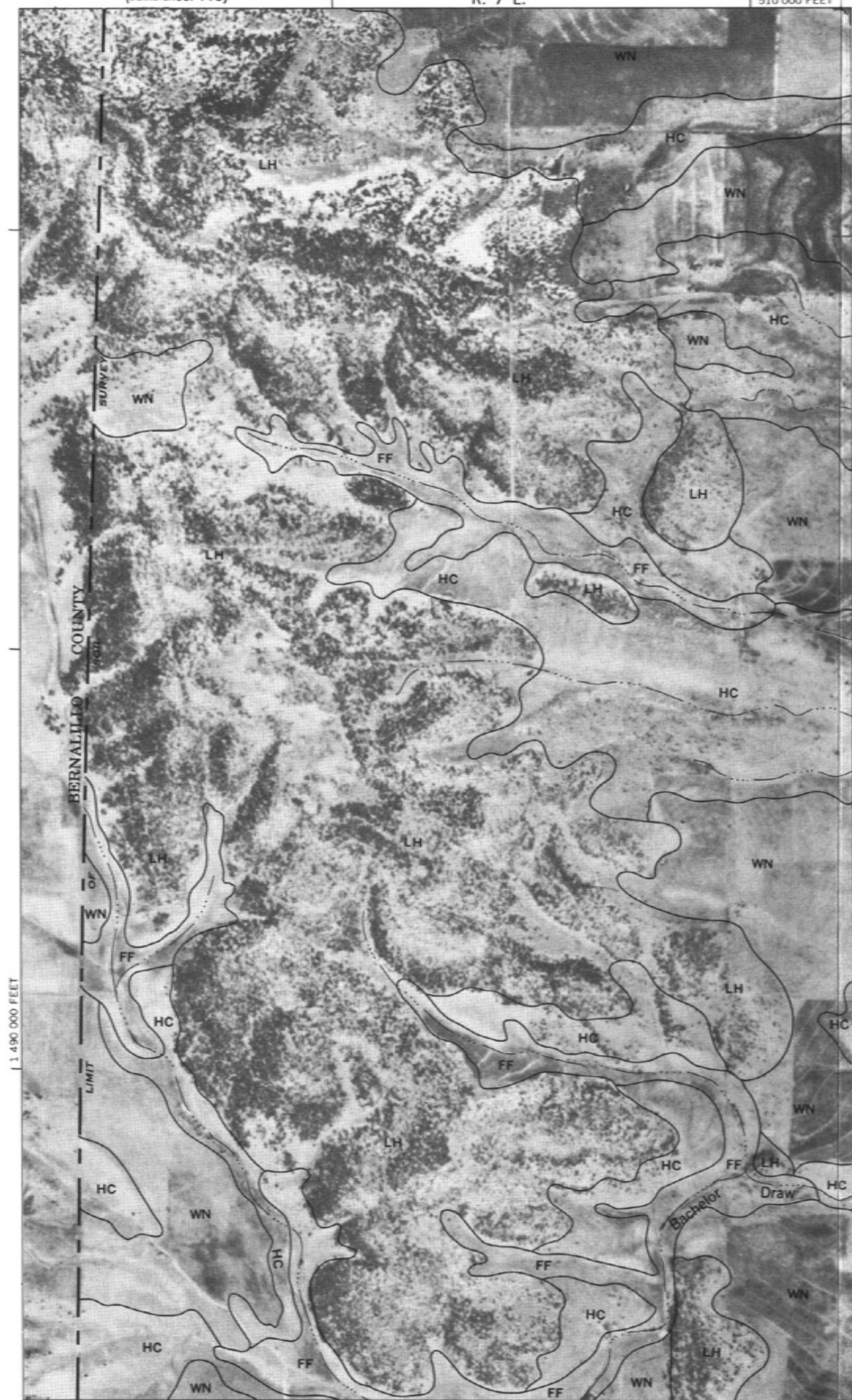
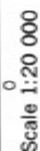
T. 10 N. 1 500 000 FEET T. 11 N.

Joins sheet 122)

(Joins sheet 129)

from 1963-1964 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service,

SANTA FE AREA, NEW MEXICO NO. 128



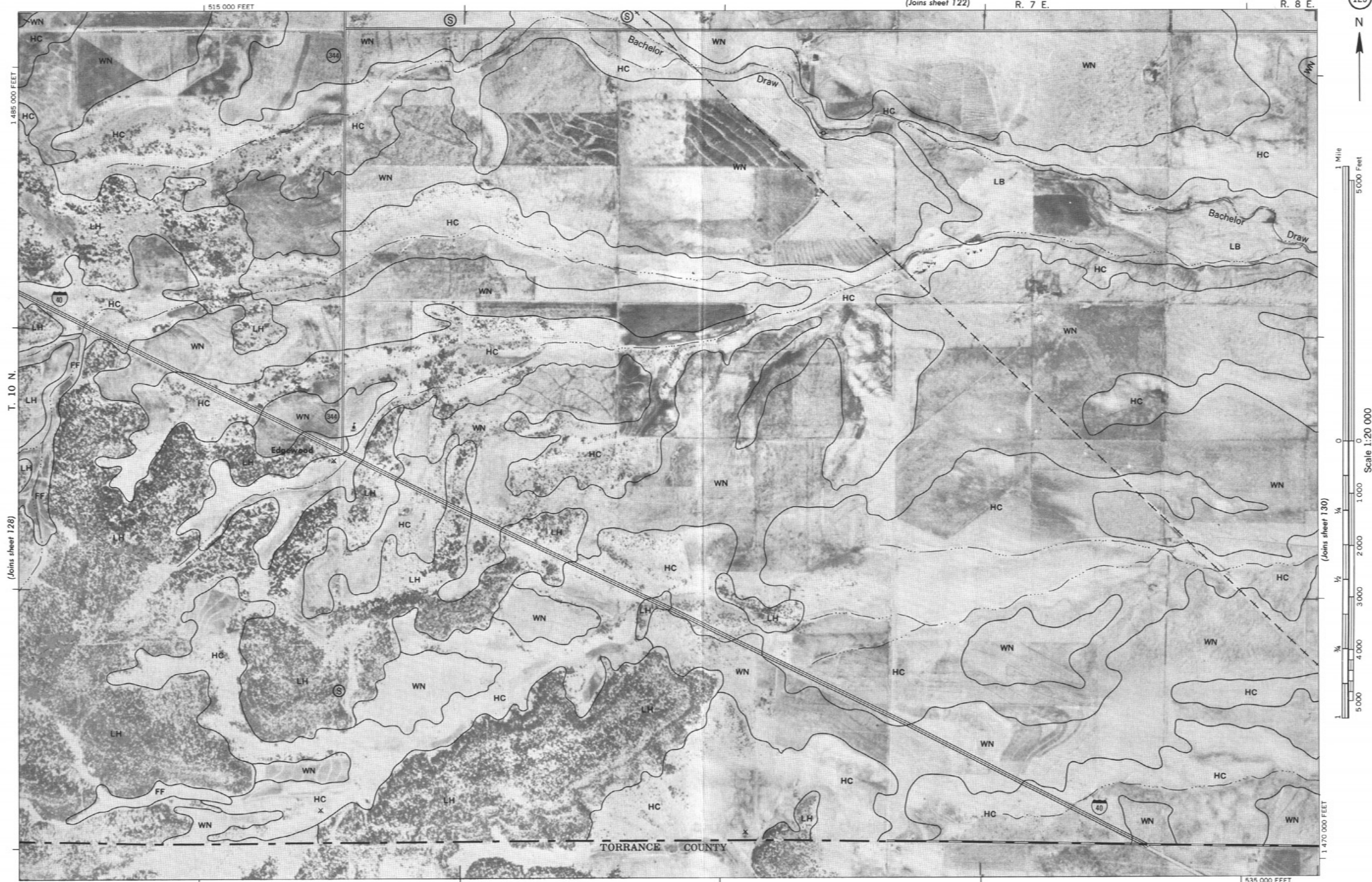
INSET



505 000 FEET



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

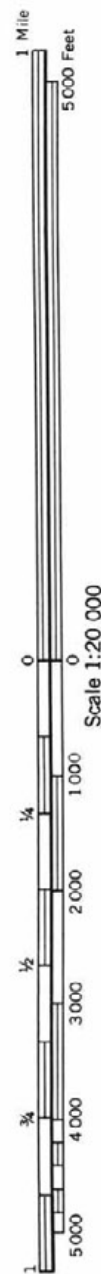


( Joins sheet 130)

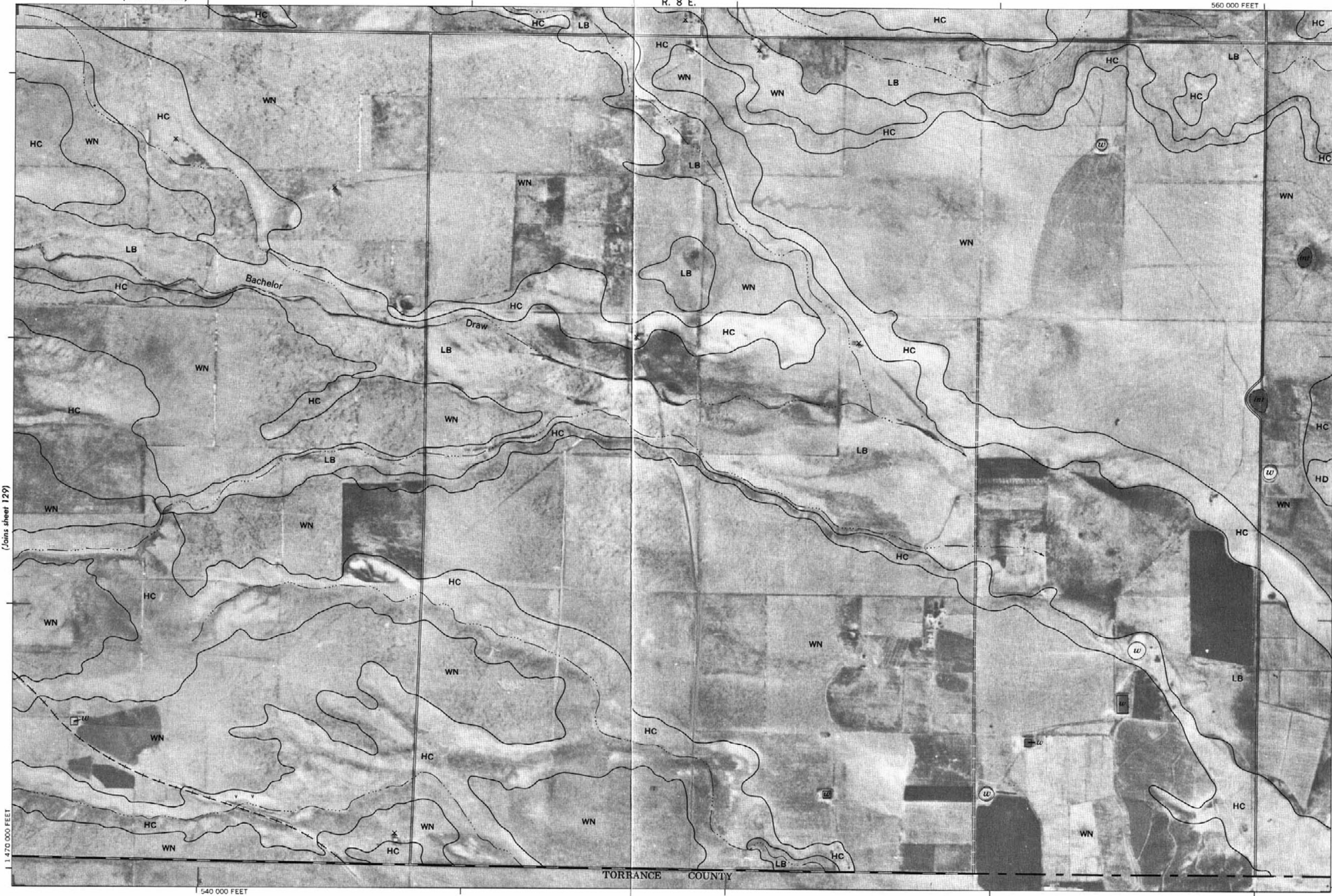
1 470 000 FEET



(Joins sheet 123)



(Joins sheet 129)

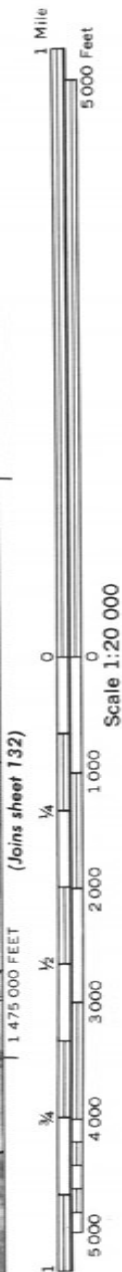
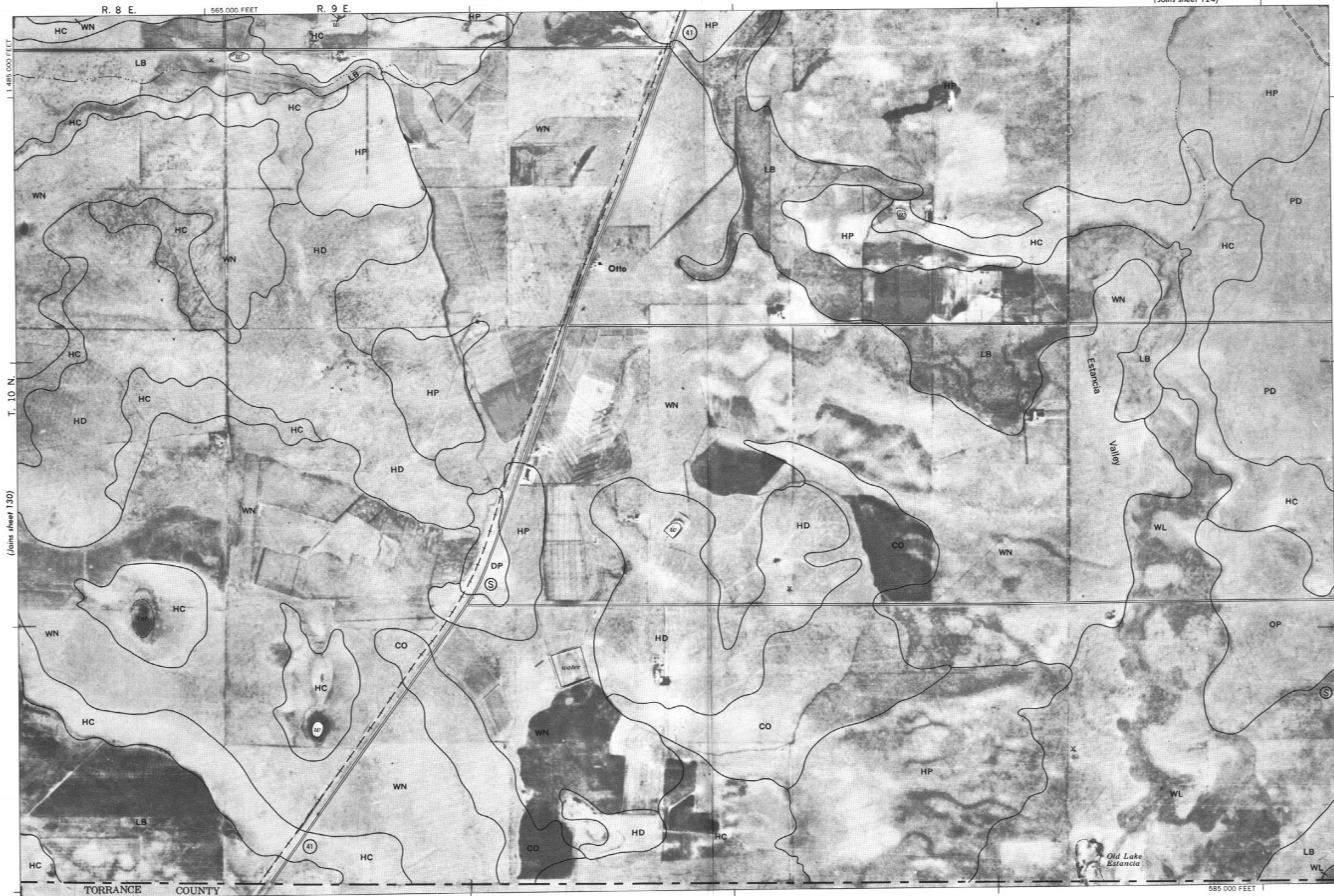


T. 10 N.

(Joins sheet 131)

Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
 the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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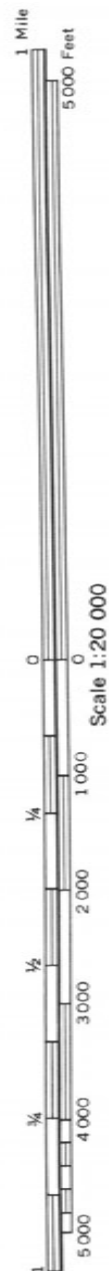
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.

(Joins sheet 130)

(Joins sheet 132)

585 000 FEET





(Joins sheet 131)



(Joins sheet 133)

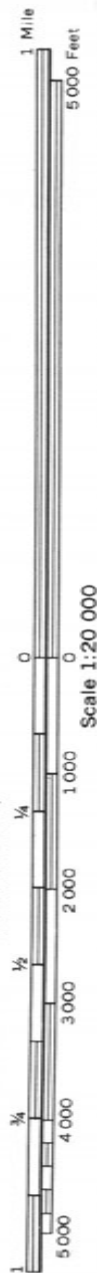
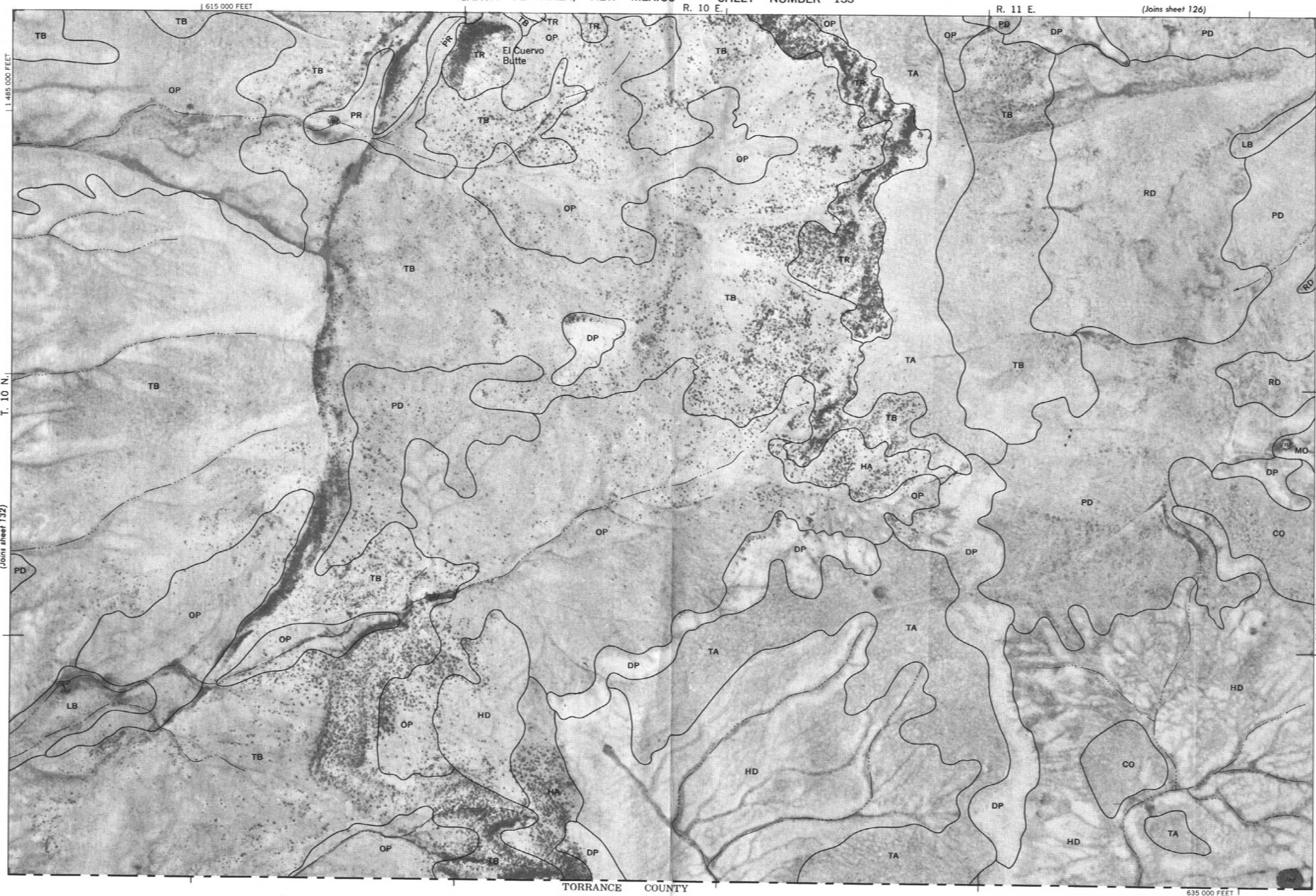
T. 10 N.

1 485 000 FEET

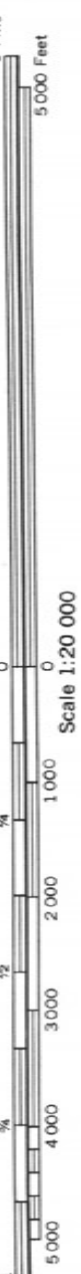
Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum.  
the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station.  
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T. 10 N.

(Joins sheet 133)

1 475 000 FEET

640 000 FEET

1 485 000 FEET

SAN MIGUEL COUNTY

TORRANCE COUNTY



Photobase from 1953-1954 aerial photography. Positions of 5,000-foot grid ticks based on the New Mexico plane coordinate system, central zone, 1927 North American datum, the United States Department of the Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station. This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service.